

AMERICAN JOURNAL OF OPHTHALMOLOGY

THIRD SERIES FOUNDED BY EDWARD JACKSON

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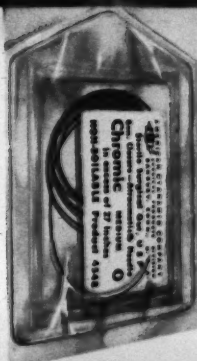
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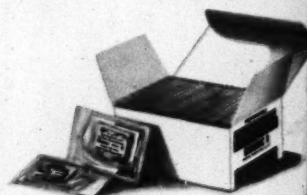


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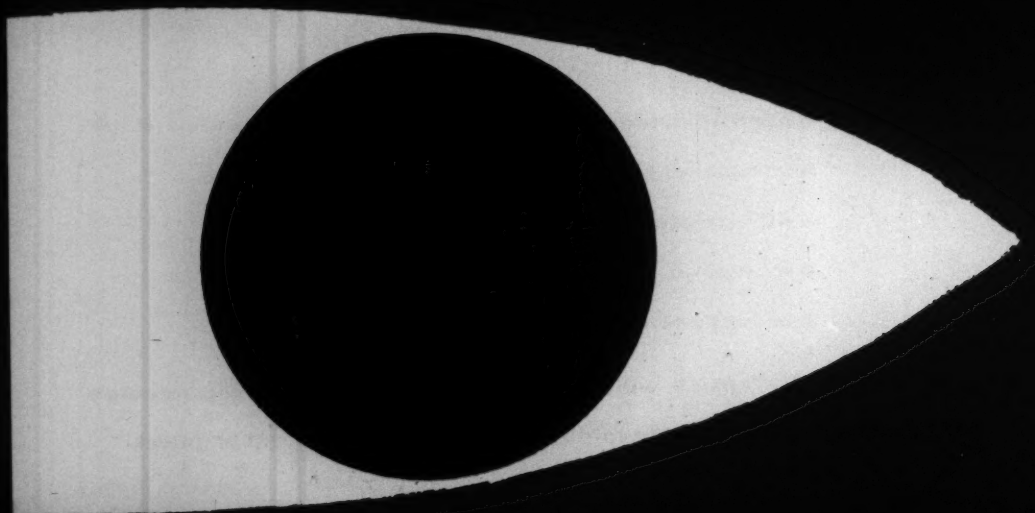
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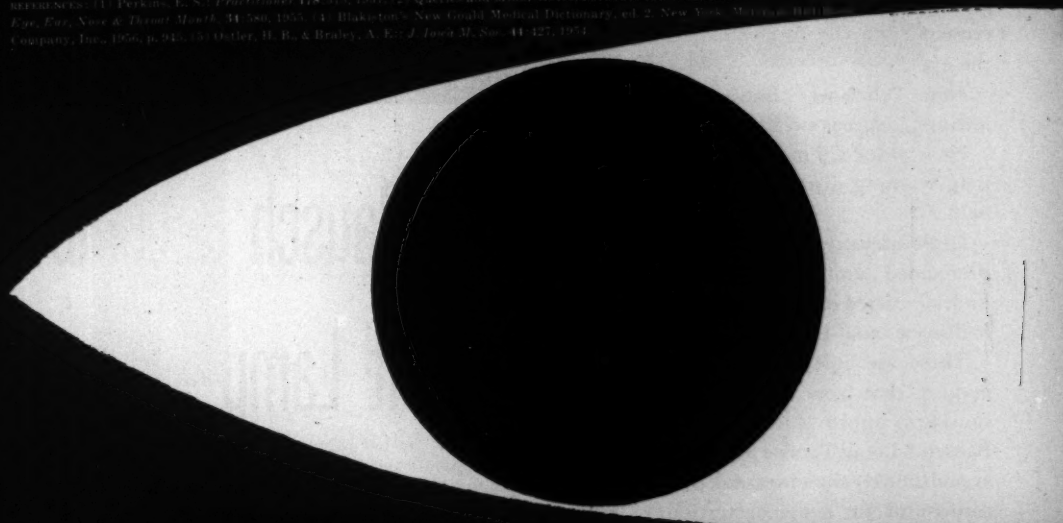
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REFERENCES: (1) Perkins, E. S., *Proctitioner* 178-179, 1957. (2) Querec and Minor Notes, *J. A.M.A.*, 161-1932, 1956. (3) Smith, C. H., *Eye, Ear, Nose & Throat Month.* 34-596, 1955. (4) Blackiston's New Gould Medical Dictionary, ed. 2, New York, McGraw-Hill Book Company, Inc., 1956, p. 945. (5) Ostler, H. R., & Bradley, A. E., *J. Inst. M. Soc.* 41-127, 1954.



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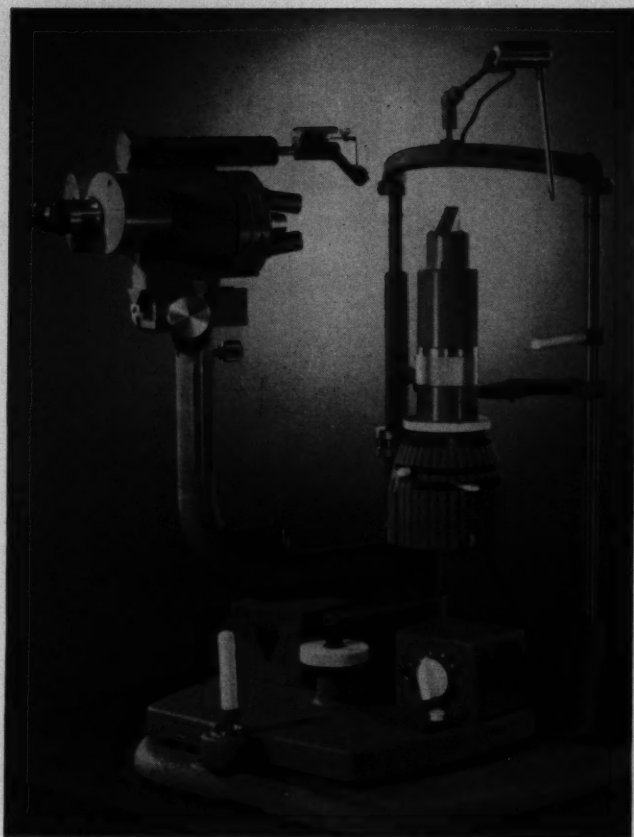
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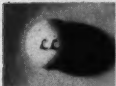


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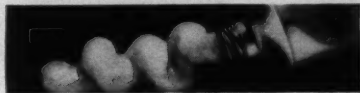


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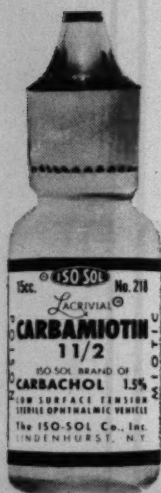
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1. **New and Nonofficial Drugs:** J. B. Lippincott Company, Philadelphia, 1958, p. 243.

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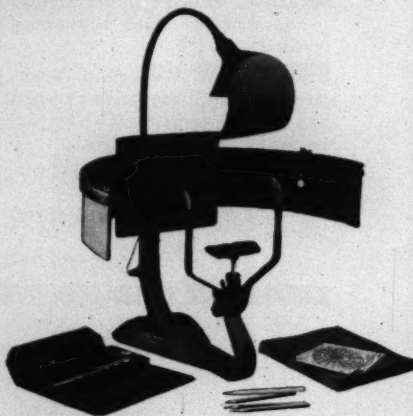
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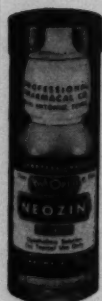
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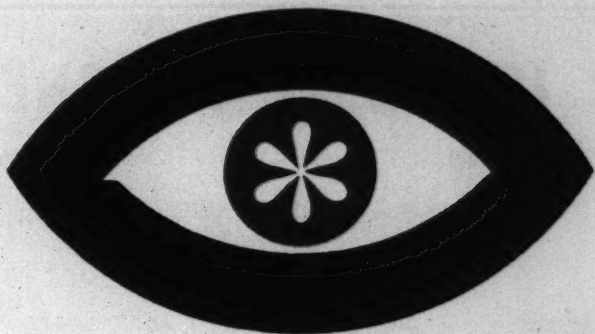
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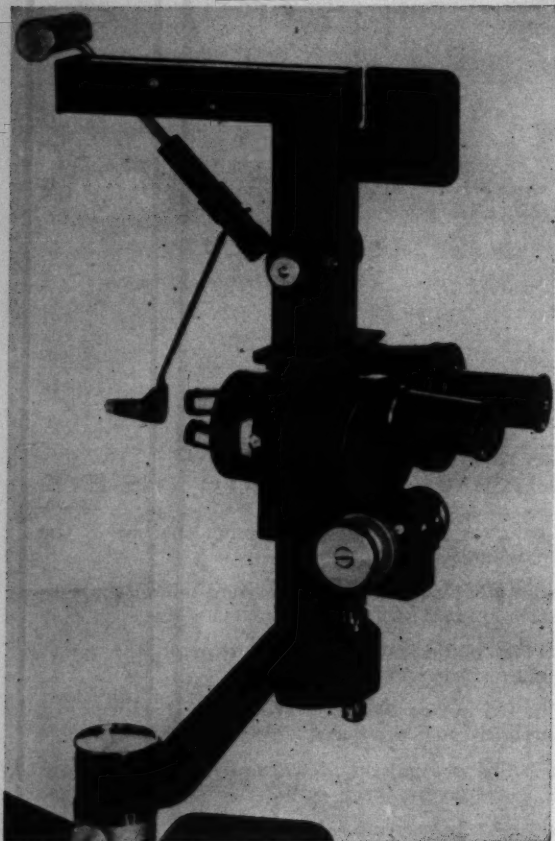
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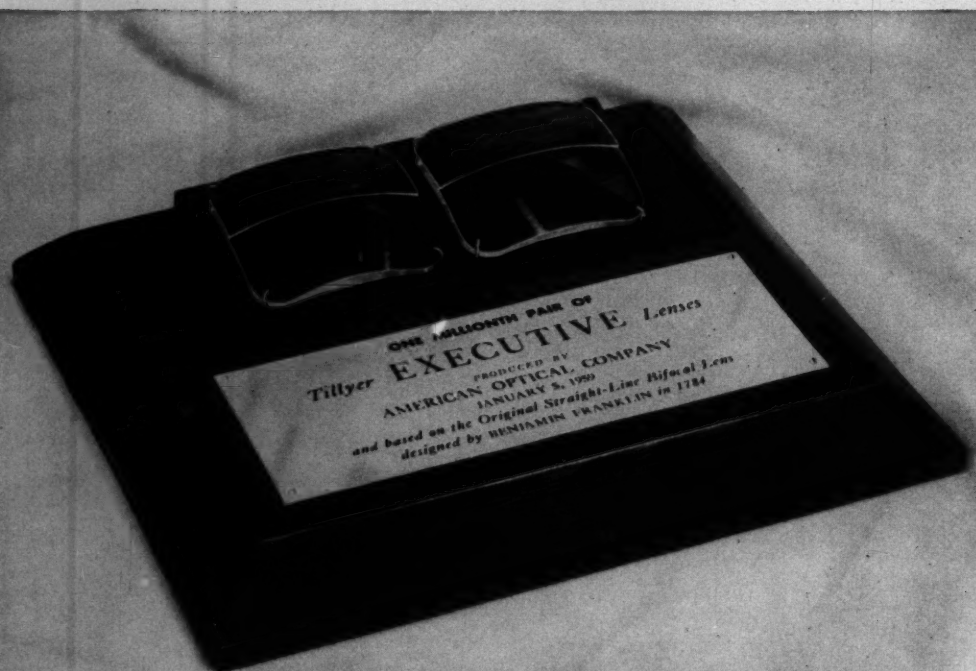


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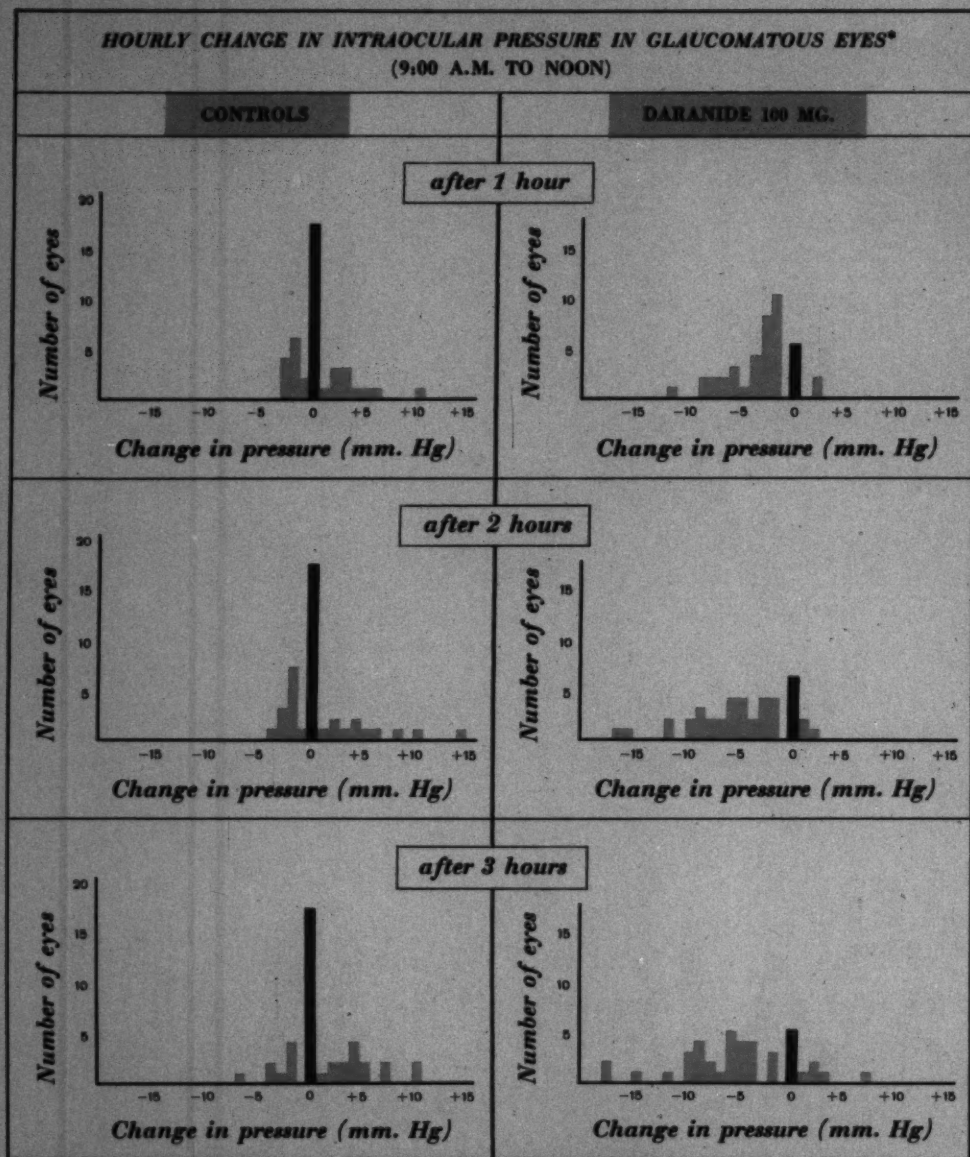
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*Gonzales-Jimenez, E., and Leopold, I. H.: The Effect of Dichlorphenamide (A Carbonic Anhydrase Inhibitor) on the Intraocular Pressure of Humans, *A.M.A. Arch. Ophthalm.* 60:427, Sept. 1958.

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$$\dagger \frac{\text{Aqueous flow after treatment} - \text{Aqueous flow before treatment}}{\text{Aqueous flow before treatment}} \times 100$$

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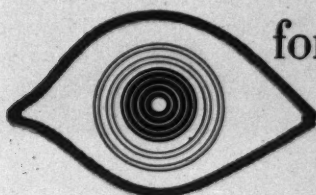
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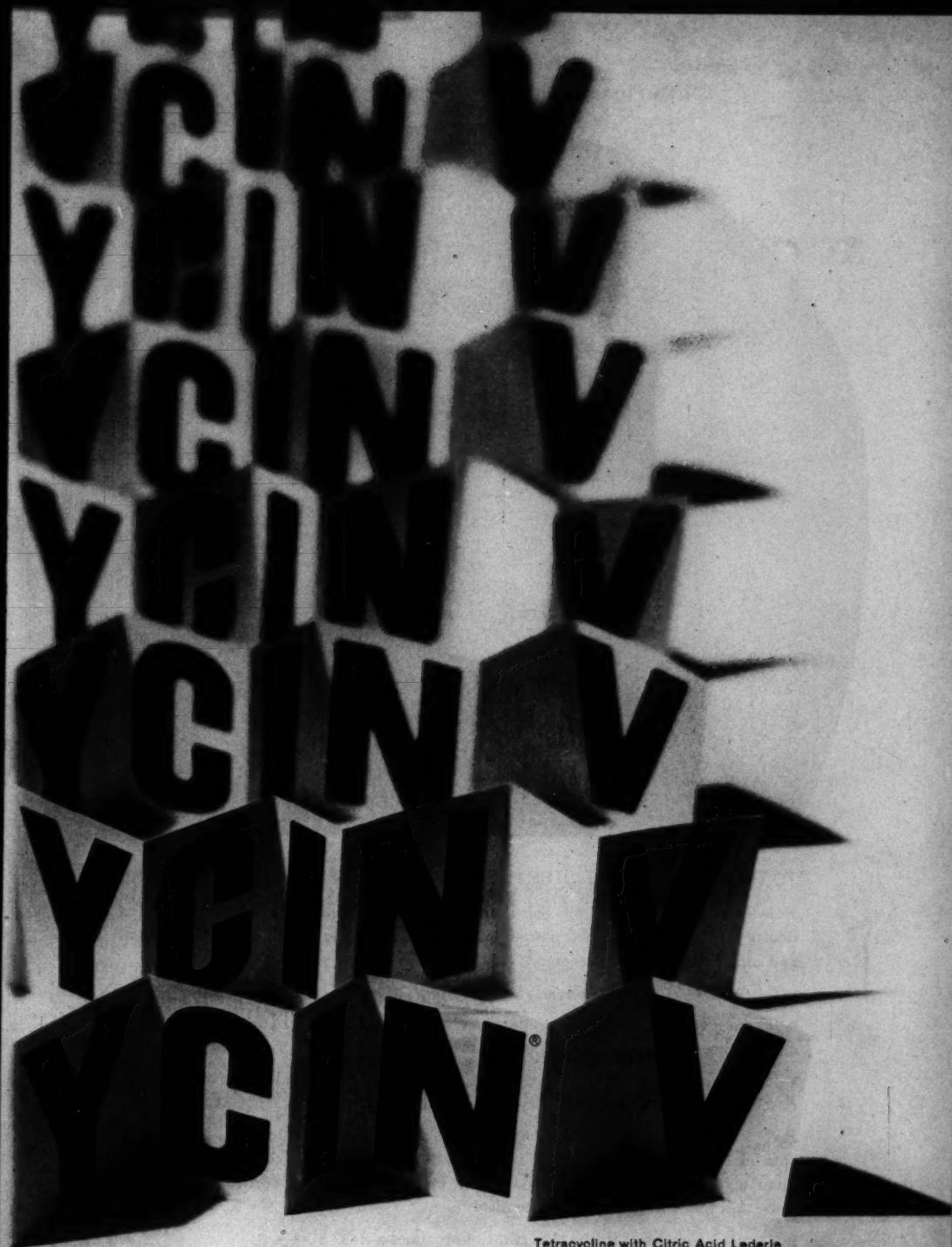
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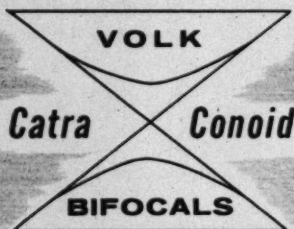
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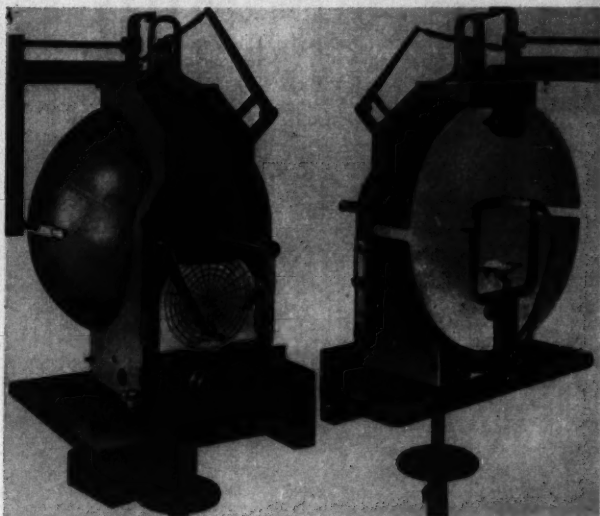
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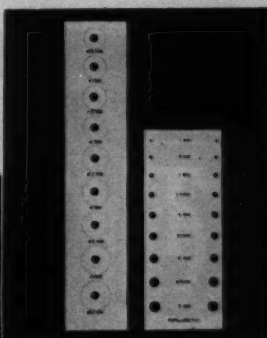


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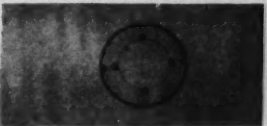
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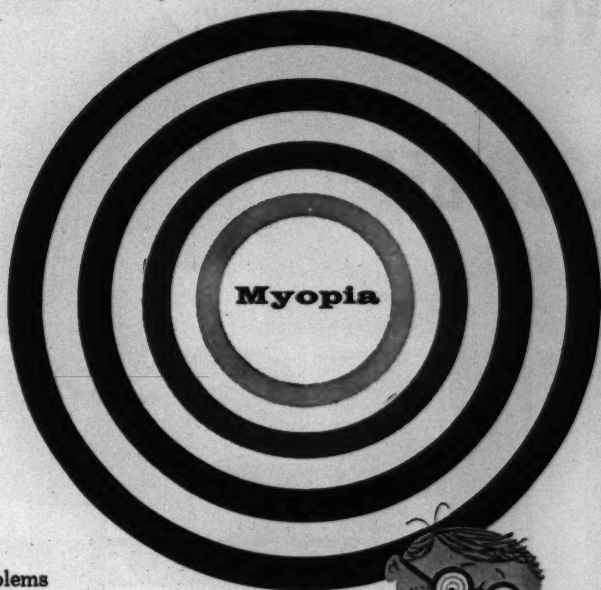
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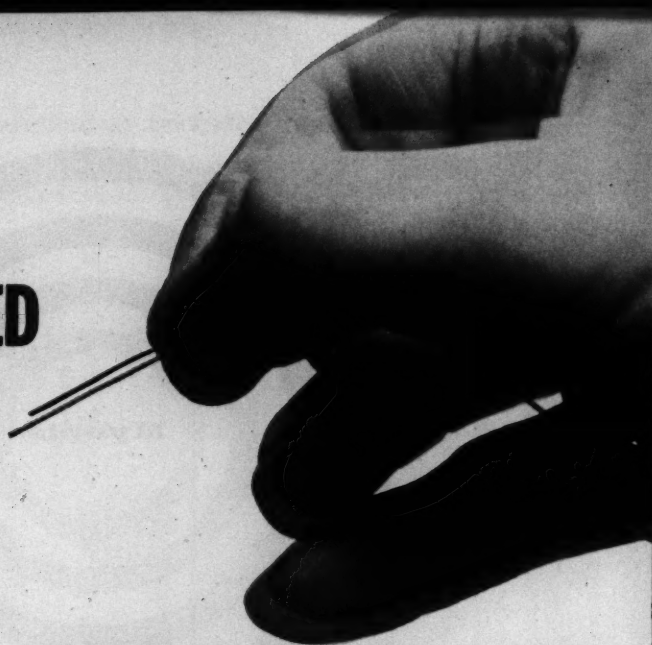
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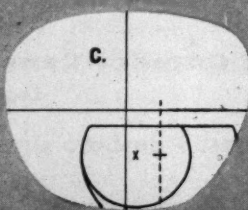
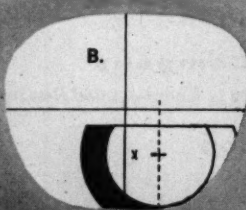
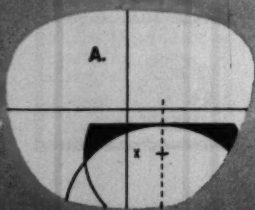
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DEGENERATION OF THE PERIPHERAL RETINA*

REPORT OF AN INSTRUCTIVE CASE

J. REIMER WOLTER, M.D., AND W. WEBB WILSON, M.D.

Ann Arbor, Michigan

Certain types of nonspecific degenerative changes of the peripheral retina can be observed at ophthalmoscopic and histologic examination. These changes may occur as primary processes in the so-called senile or presenile conditions and they may also be secondary to many different eye diseases.

It is an interesting fact that the types of degeneration found under the most different pathologic conditions in the peripheral retina are very limited in number. This can be explained by the fact that well-differentiated tissues—as the ones of the retina and the pigment epithelium—allow for only few reactions of their tissue elements.

The common degenerative changes of the peripheral retina seem to be composed of atrophy, degeneration, pathologic proliferation, and hyalinization of the structures of the retina and the pigment epithelium. Changes of the peripheral choriocapillaris and the peripheral part of the vitreous body which is attached to the peripheral retina are also typically seen under such degenerative conditions. The changes of the vitreous and their nature and significance, however, are very difficult to demonstrate with histologic methods and are, as yet, much less understood than those of the peripheral retina, pigment epithelium, and choriocapillaris.

The present paper represents the clinical

and histologic demonstration of the degenerative changes in the peripheral retina of the left eye of a 70-year-old man. This case is extremely instructive since it exhibits in one single eye all the types of degeneration of the peripheral retina which we have ever seen in such primary or secondary degenerative processes of the human eye. A special histologic stain is used to demonstrate new aspects of the development and nature of these degenerative changes.

CASE HISTORY

This is the case of a 70-year-old white man who suddenly noticed that he could not see straight ahead out of his left eye on January 6, 1957, while driving. He went to see his ophthalmologist in Detroit who told him that he had a hemorrhage in his left eye. No treatment was suggested. The patient observed a progressive further loss of vision in his left eye through the next months.

About one year later, on March 18, 1958, the patient came for an eye examination to Dr. M. Petrohelos in Ypsilanti, Michigan. Dr. Petrohelos found an intraocular tumor at the posterior pole of the left eye which also involved the optic papilla. He advised the patient to see Dr. H. F. Falls of this eye clinic for a consultation.

Dr. Falls examined the patient on April 16, 1958. He found his vision to be 20/20+, O.D., and hand movements temporally, O.S. The external examination revealed a few degrees of left divergent strabismus. Funduscopic examination showed in the right eye many drusen (colloid bodies) all over the retina including the posterior pole and the periphery. Especially large drusen, cystoid degeneration of the retina, and pigmentary changes, however, were seen far out in the peripheral retina. The fundus of the left eye exhibited a tumor of about eight diopters' elevation which had invaded the nasal part of the optic disc and was extending nasally. This tumor was not very pigmented but did contain a great number of newly formed blood vessels. The peripheral retina of the left eye showed extensive degenerative changes which were very

* From the Department of Ophthalmic Surgery and the Laboratory of Neuropathology and Neuro-Ophthalmology of the University of Michigan Hospital. Supported by Grant B-475-C4 of the United States Department of Public Health, Education, and Welfare.

similar to those of the right eye. There were cystoid degeneration of the retina, large yellowish drusen, some of which appeared very superficial, and a very marked irregularity of pigmentation. This latter irregularity of the pigment seemed ophthalmoscopically composed of areas with complete loss of pigment epithelium while other areas had a motheaten appearance and others again showed a spotty increase of pigmentation. The observation of these degenerative changes which were about the same in the normal and in the eye with the intraocular tumor was the basis for this study since we were able to locate and examine these ophthalmoscopically observed peripheral changes with our histologic methods after the enucleation of the left eye. Both fundi also exhibited marked arteriosclerosis of the retinal blood vessels.

The left eye was enucleated on April 24, 1958, by Dr. Petrohelos who fixed and injected it immediately after removal with bromformalin (Cajal solution).

HISTOLOGIC EXAMINATION

METHOD

Half of the globe and a part of the nasal periphery with some of the above-mentioned degenerative changes were imbedded in paraffin, cut in serial sections, and stained by routine methods of eye pathology. Frozen sections were made of the other half of the globe and of another part of the nasal periphery with the advanced degenerative changes. These latter sections were stained with the silver carbonate methods of del Rio Hortega as described by Scharenberg and Zeman.¹

All illustrations presented in this paper are unretouched photomicrographs.

RESULTS

The macroscopic examination of the left eye of this patient revealed a solid tumor to be located in the retrorretinal space nasally of the optic disc. The peripheral retina exhibited very interesting macroscopic findings. There were large irregular and rather well-circumscribed areas of complete depigmentation.

Figure 1 represents a photograph of the nasal and inferior part of the peripheral ocular wall with the peripheral retina, the ciliary body, iris, and cornea at transillumination. It demonstrates the well-circum-

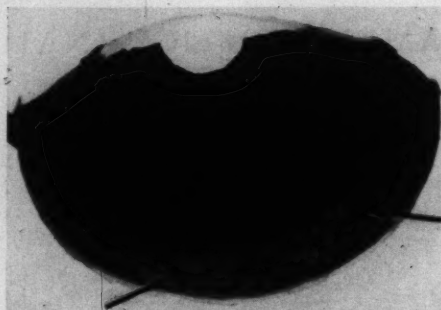


Fig. 1 (Wolter and Wilson). Photograph of the nasal and inferior ocular wall with the peripheral retina, the ciliary body, the iris, and the cornea at transillumination. The well-circumscribed translucent areas of depigmentation are clearly visible (arrows).

scribed areas of pigment loss very well. With direct illumination and a low-power microscope it was also possible to see the large yellowish drusen of the peripheral retina which had been observed with the ophthalmoscope.

A dense layer of gelatinous, condensated vitreous was found to be firmly attached to the peripheral retina which exhibited the degenerative changes. This layer of dense vitreous represented a bandlike formation all around the periphery of the retina. It was not possible to remove this layer from the retina without damaging the latter. The central and most of the posterior vitreous were liquefied.

Histologically the tumor at the posterior pole was found to be a malignant melanoblastoma of the choroid of the spindle-A cell type. The tumor showed mainly endophytic growth and had invaded the overlying retina. It had also invaded the inner part of the optic disc and was found to extend through the sclera using the pathway of a ciliary nerve. An accumulation of tumor cells was found in the episclera of this area. Most of the nerve fibers of the nerve fiber layer were destroyed by the tumor as they traversed the inner part of the optic disc. Some fiber bundles, however, on the nasal side of the disc were found to be preserved.

The further histologic description will be limited to a detailed demonstration of the changes in the peripheral retina, pigment epithelium, vitreous, and choriocapillaris, which are the subject of this paper.

Extensive cystoid degeneration was found in the peripheral retina. This was most advanced in the inner nuclear layer (fig. 2). But the cystoid degeneration had extended in some areas all through the retina. The inner and outer limiting membranes and some atrophic interconnecting bundles of Müller's radial fibers were all that was left of the peripheral retina in these latter areas.

Other areas of the peripheral retina were without cystoid degeneration. In these areas, however, severe degeneration had resulted in advanced changes of the retinal structures. Virtually all the neurons of the inner layers were missing.

The blood vessels were hyalinized, mostly obliterated, and partly atrophic (fig. 3).

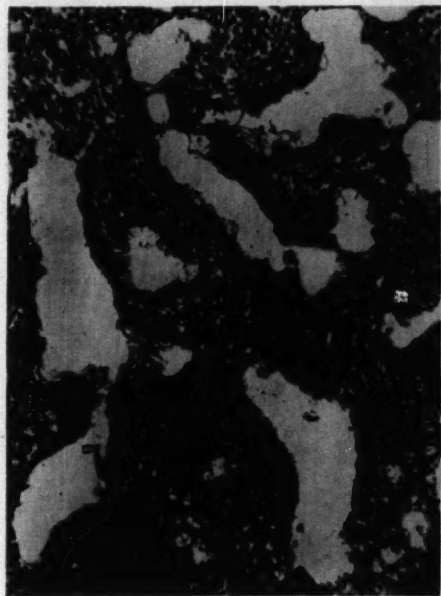


Fig. 2 (Wolter and Wilson). Flat section through the inner nuclear layer of the peripheral retina which shows the early stage of cystoid degeneration. (Hortega method, photomicrograph.)



Fig. 3 (Wolter and Wilson). Flat section through the inner layers of the peripheral retina the blood vessels of which show hyalinization, partial obliteration, and some hypertrophy of the perivascular glia (a). Only one ganglion cell (b) has survived in the whole area of the photograph. (Hortega method, photomicrograph.)

Around these atrophic blood vessels of the peripheral retina a marked hypertrophy and pathologic proliferation of the perivascular glia were found (figs. 3, 4, and 5). Coarse processes of perivascular glia were seen to surround and interconnect the more or less atrophic blood vessels (fig. 4) and the same processes extended into the retinal tissues (fig. 5).

Many different stages of atrophy of the blood vessels and proliferation of the perivascular glia were seen and it was observed that the hypertrophic perivascular glia often survived the degenerating structures of the blood vessels (fig. 5) which finally disappeared in the process of atrophy. Pathologic formations of bizarre perivascular glia were found to form large structures in the peripheral retina. These structures often looked spiderlike (figs. 6, 7, 8, and 9) and many



Fig. 4 (Wolter and Wilson). Flat section through another area of the inner layers of the peripheral retina which also exhibits degeneration and hyalinization of the blood vessels. There is extensive proliferation of perivascular glia (arrows). (Hortega method, photomicrograph.)

Fig. 5 (Wolter and Wilson). High-power view of coiled-up structures of proliferating perivascular glia around an atrophic blood vessel of the inner nuclear layer of the peripheral retina. (Hortega method, photomicrograph.)



Fig. 6 (Wolter and Wilson). Bizarre spiderlike formation of surviving perivascular glia at the limit between ganglion cell and inner nuclear layers after atrophy of blood vessels in the peripheral retina. Part of a lamellated hyaline body is seen in the lower part of the picture. (Hortega method, photomicrograph.)

Fig. 7 (Wolter and Wilson). Spiderlike hyalinized structure of proliferated perivascular glia around the remnants of an atrophic blood vessel at the limit between inner nuclear and ganglion cell layers of the peripheral retina. (Hortega method, photomicrograph.)



Fig. 8 (Wolter and Wilson). More advanced stage of hyalinization of proliferated perivascular glia in the inner layers of the peripheral retina. Such necrotic structures of perivascular glia become the nuclei of progressive hyaline deposition. (Hortega method, photomicrograph.)

Fig. 9 (Wolter and Wilson). Late stage of hyalinization of proliferated perivascular glia in the peripheral retina which represents a lamellated hyaline body (left in picture). There is also an early spiderlike formation of the same process (right). Hortega method, photomicrograph.)

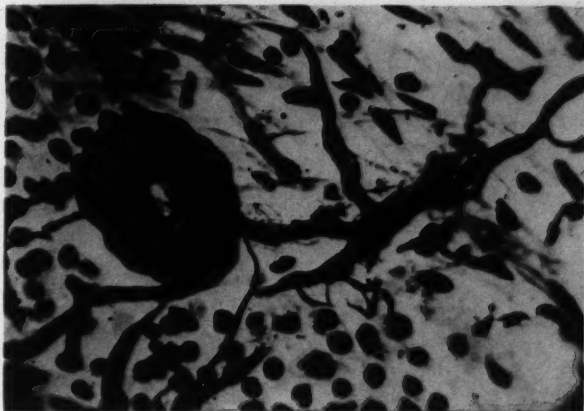




Fig. 10 (Wolter and Wilson). Medium-sized hyaline body of the peripheral retina with an unstained central space. Fragments of the cellular processes of the perivascular glia are still seen protruding from the hyaline body. (Hortega method, photomicrograph.)

Fig. 11 (Wolter and Wilson). Large hyaline bodies of perivascular glial origin in the peripheral retina. (Hortega method, photomicrograph.)

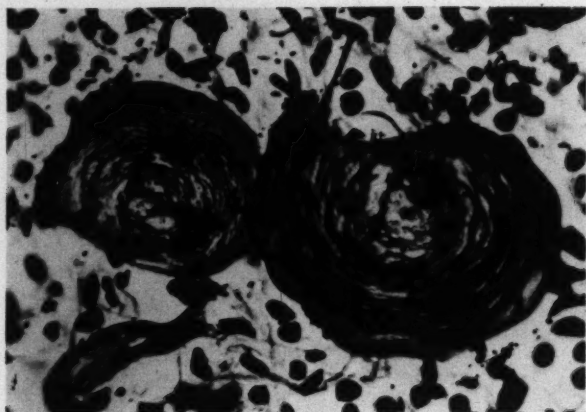
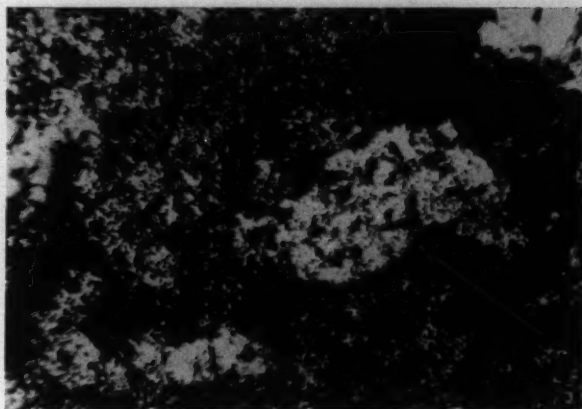


Fig. 12 (Wolter and Wilson). Flat section of the central retina at low power. The network of retinal astroglia is seen to be somewhat hypertrophic but without signs of degeneration. A retinal blood vessel is also seen. (Hortega method, photomicrograph.)

Fig. 13 (Wolter and Wilson). Flat section through the pigment epithelium of the peripheral retina exhibiting an area of pigment epithelium cells which lost most of their pigment granules and show some intracellular hyalinization (arrow). All pigment cells in the picture show a very irregular pigmentation. (Hortega method, photomicrograph.)



of these spiderlike formations showed advanced hyalinization.

The end-stage of the hyalinization of these spiderlike structures of hypertrophic perivascular glia was round hyaline bodies (figs. 9, 10, and 11). Most of these bodies were lamellated and showed an unstained center. Some of them were very large (up to 100 microns). Swollen fragments of hyalinized processes of the degenerated perivascular glia were often found around these hyaline bodies (figs. 10 and 11). In contrast to these extensive glial changes of the peripheral retina the glial structures of the central retina were hypertrophic but showed normal arrangement and no degeneration (fig. 12).

Degenerative changes of the pigment epithelium were another interesting finding in the peripheral retina of this eye. The histologic sections revealed the pigment epithelium to be completely missing in large islands. Some of the pigment granules of the destroyed pigment epithelium were seen piled up around the blood vessels of the adjacent retina. Most of the pigment, however, had completely disappeared. Scarlike astroglia had replaced the outer retinal layers in the areas of complete loss of the pigment epithelium and the choriocapillaris was also completely degenerated.

In other areas the pigment epithelium was

preserved as a layer and contained pigment granules in about normal amounts but in a very irregular distribution. Many drusen (colloid bodies) were found in these areas of the pigment epithelium. All stages of the development of such drusen could be seen. In the first stages groups of a few cells of the pigment epithelium showed marked loss of pigment granules and also intracellular accumulation of hyaline substance (fig. 13). In the later stages these cells lost all the pigment, their cellular nuclei, and membranes, and they finally became completely hyalinized (figs. 14 and 15). They then represented large round or oval hyaline bodies (drusen) which were firmly connected with Bruch's membrane and remained in the place of the degenerated pigment epithelium cells. Many of these drusen were found in the process of further growths by hyaline degeneration of more cells of the pigment epithelium at their circumference (fig. 15). The size of these drusen was about the same as that of the large hyaline bodies found in the same zone of the peripheral retina (up to 100 microns) (fig. 11).

It was surprising to observe that not all the cells of the peripheral pigment epithelium which had lost their pigment granules also showed complete atrophy or the process of intracellular hyalinization as already described. Large areas were found to ex-

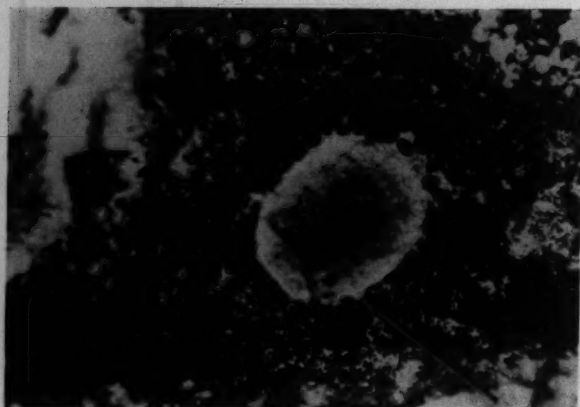


Fig. 14 (Wolter and Wilson). Flat section through the pigment epithelium of the peripheral retina exhibiting a large drusen of hyaline substance (arrow). Cellular nuclei of some degenerated and completely hyalinized cells are still visible at the margin of the drusen. (Hortega method, photomicrograph.)

hibit a very marked loss of pigment granules but did not show any hyalinization or other signs of cellular necrosis (fig. 16). The cells of the areas seemed well preserved and exhibited normal cellular nuclei and distinct cellular membranes but they had lost virtually all their pigment.

In contrast to these degenerative changes of the peripheral pigment epithelium there was also extensive local proliferation in some areas. Piles of proliferated cells of the pigment epithelium were seen as spotlike formations (fig. 17) in the same peripheral areas which exhibited the other changes here described. The proliferating cells showed different stages of hypertrophy and secondary

degeneration. Many of them were seen to contain large amounts of intracellular hyaline (fig. 17). In many areas this process of proliferation and secondary hyaline degeneration had finally resulted in the formation of another type of drusen on Bruch's membrane.

The choriocapillaris of the peripheral retina of this eye showed changes of advanced degeneration. In many areas the choriocapillaris was virtually missing. In others its blood vessels contained no blood and the lumen of many capillaries appeared obliterated. The larger blood vessels of the peripheral choroid were preserved and contained blood. But the wall of these larger vessels showed extensive fibrosis.

Fig. 15 (Wolter and Wilson). Drusen of the pigment epithelium of the peripheral retina in a flat section at higher power. The process of further growth of this drusen by hyaline degeneration of one cell at the margin of the drusen is clearly visible (arrow). (Hortega method, photomicrograph.)

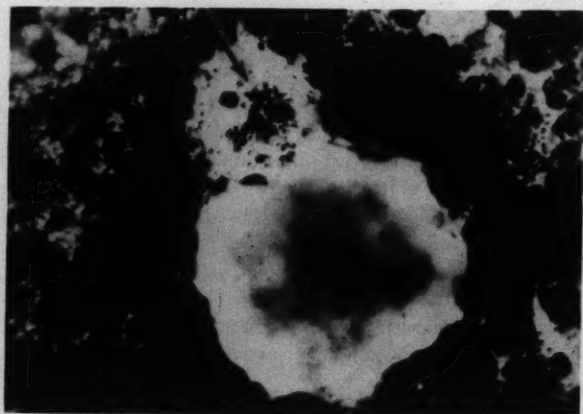
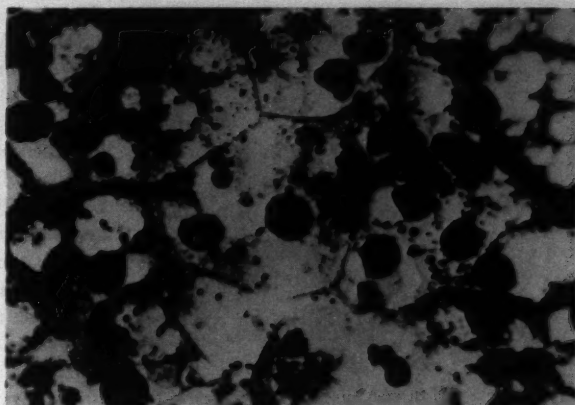


Fig. 16 (Wolter and Wilson). An area of the peripheral pigment epithelium which shows an almost complete loss of its pigment granules. The flat section very well shows the preserved cellular nuclei and the cement lines of the cellular membranes. (Hortega method, photomicrograph.)



The histologic examination of the layer of dense vitreous which had macroscopically been found to be firmly attached to the peripheral retina revealed some surprising facts. This vitreous appeared to contain a meshwork of fibrillar structures which was very distinctly visible after the silver stain (figs. 18, 19, and 20). These fiber structures were densely interconnected and had one main direction. The surprising fact was that these fiber structures extended well into the superficial tissues of the peripheral retina (figs. 18 and 19). The fibers formed small fibrillar branches within the retina which resembled numerous rootlike anchorages. We were not able to demonstrate the inner limiting membrane and its relationship to these fiber struc-

tures of the vitreous in the peripheral retina of this case. It is of further interest that this layer of condensed vitreous not only contained this dense meshwork of fibers but also clearly exhibited numerous cellular nuclei (fig. 20).

COMMENT

It must be emphasized at this point that both eyes of this 70-year-old patient exhibited the same degenerative changes of the peripheral retina at ophthalmoscopic examination. This fact indicates that these changes in the left eye were mainly due to so-called senile degeneration and not a specific result of the tumor at the posterior pole.

We chose the present case for this demon-



Fig. 17 (Wolter and Wilson). A pile of proliferated cells of the pigment epithelium of the peripheral retina (arrow). Many of the proliferated cells show intracellular hyaline accumulation. (Hortega method, photomicrograph.)



Fig. 18 (Wolter and Wilson). Low-power view of the fibrillar structures of the layer of dense vitreous inside of the peripheral retina. These interconnected fibers extend into the retina (lower part of picture). (Hortega method, photomicrograph.)

stration since it allows for a description of the multitude of virtually all types of peripheral degeneration that we know. This description is given within a short demonstration of all worthwhile clinical and histologic findings. Some of the findings may later prove to be of importance when the cause and nature of the degenerations of the peripheral retina are better understood. It is our impression that a report of a typical case is always much more valuable and instructive than a general discussion.

The degenerative changes of the peripheral fundus as seen with the ophthalmoscope were histologically found to be composed of changes in the retina, the pigment epithelium, the choriocapillaris, and the vitreous.

The retina exhibited extensive cystoid degeneration. This is a very common degen-

erative change of the peripheral retina. It develops by a slowly progressive necrosis and liquefaction of retinal tissues which usually starts in the inner nuclear layer. In the advanced stages only the inner and outer limiting membranes with some interconnecting bundles of atrophic radial fibers of Müller remain of the retina. The nature and clinical significance of the cystoid degeneration seem to be rather well understood.

As to the development there seem to be two main schools of thought in the literature to explain the cause of the cystoid degeneration:

The first one believes that cystoid degeneration of the retina is caused by a mechanical alteration of the retina by the degenerating vitreous which is attached to the retina of this area. This mechanical damage is thought to result in secondary vascular changes and

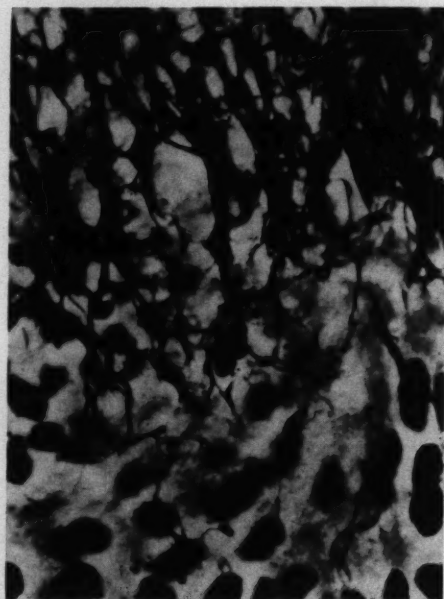


Fig. 19 (Wolter and Wilson). High-power view of an area of Figure 18 which shows the branching and rootlike anchoring of the fiber structures of the vitreous in the retina (lower part of the picture). The inner limiting membrane could not be demonstrated in this area. (Hortega method, photomicrograph.)

atrophy of the retinal tissues. Later in the process the same mechanical damage is supposed to result in the occurrence of retinal tears and retinal detachment.

The other school considers the vascular changes as the primary defect which then leads to the cystoid degeneration. Many ophthalmologists now seem to believe that both theories may be right. This latter view was recently taken in a paper of Ullerich.² This author reviewed the literature and proved with an excellent histologic study the direct relation of the posterior detachment of the vitreous and the peripheral cystoid degeneration of the retina in the area of the anterior vitreous attachments. However, Ullerich² also pointed out that similar cystoid degeneration of the peripheral retina may occur as "primary degeneration" following obliterative vascular changes.

Another theory has been recently introduced by Teng and Katzin.⁸ These authors believe that the motility of accommodation is the important and causative factor in cystoid degeneration. These mechanical factors are created by a combination of the traction of the ciliary muscle and the senile vitreoretinal adhesions at the peripheral retina.

The present case also exhibited large hyaline bodies in the peripheral retina which were so big that they were visible with the ophthalmoscope. The histologic study revealed that these hyaline bodies had developed from proliferating perivascular glia which survived the destruction of peripheral retinal blood vessels. The proliferated perivascular glia degenerated and structures of it became the nuclei of increasing hyaline deposition. Thus large lamellated hyaline bodies developed which without doubt represented the histologic equivalent of the superficial type of "drusen" which were seen with the ophthalmoscope. Perivascular glia of the human retina is a tissue element which was only recently discovered.^{4,8} It is considered to be part of the retinal neuroglia and to be of neuroectodermal origin. Its function is not



Fig. 20 (Wolter and Wilson). The interconnected fiber structures of the layer of condensed vitreous which exhibit cellular nuclei. (Hortega method, photomicrograph.)

known yet. The perivascular glia is known, however, to proliferate in many primary or secondary conditions of the retina which exhibit atrophy or obliteration of the retinal blood vessels.^{5,6}

The finding of such drusenlike hyaline bodies in the peripheral retina which develop by hypertrophy and secondary degeneration of perivascular glia is new. The proliferation and final degeneration of these perivascular glia seem to be a result of the obliteration and atrophy of the peripheral retinal blood vessels.

Generally it can be stated that hyaline bodies of the human retina are a rather common and nonspecific finding. They may develop in senescence and under many different pathologic conditions from continuous or interrupted nerve fibers,⁷⁻⁹ from retinal astroglia,⁸ or ganglion cells,^{10,11} and from retinal microaneurysms.¹² All these hyaline bodies look histologically very much alike.

However, these hyaline bodies seem to be always much smaller than the ones which developed from perivascular glia of the peripheral retina in the present case.

Complete disappearance of whole areas of the pigment epithelium is often found in cases which exhibit advanced degeneration of the peripheral choriocapillaris. We therefore consider the occurrence of such destruction of areas of the pigment epithelium in this case secondary to the changes of the choriocapillaris which will be discussed later. There is no doubt that some of the translucent areas of the peripheral ocular wall of the present case (fig. 1) are explained by this complete loss of the pigment epithelium.

The development of drusen (colloid bodies) of the peripheral pigment epithelium by degeneration and hyalinization of pigment epithelium cells is not a new observation.¹²⁻¹⁸ Such drusen may form by hyaline transformation of the cellular structures or by deposition of hyaline beneath the pigment epithelium on Bruch's membrane.^{14, 15} They are ophthalmoscopically seen as round yellowish spots deep in the retina and may show a small pigment ring around them. The drusen of the peripheral retina of the present eye had obviously formed by transformation of groups of pigment cells. And it was obvious that many of them were still growing at the time of enucleation since they showed hyaline degeneration of further pigment epithelium cells at their margins. The structures of these marginal cells were seen in all stages of becoming hyalinized and part of the large drusen. There is no doubt that these drusen were responsible for the ophthalmoscopic impression of the deep yellowish spots in the peripheral retina of this eye.

It is interesting that there was not only degeneration of the pigment epithelium but also local proliferation of pigment cells in some areas. This proliferation had resulted in piles of cells which contained pigment granules. However, these proliferated cells

also showed advanced degeneration and intracellular hyalinization which was secondary to the proliferation. We have no explanation for this finding. However, these piles of proliferated pigment epithelium must have caused the spotty increase of pigment which was seen with the ophthalmoscope in the peripheral retina.

The histologic observation of areas with well-preserved pigment epithelium that had lost virtually all its pigment granules is another interesting finding in the peripheral retina of this eye. We consider this loss of pigment granules combined with a survival of the cells just another stage and type of nonspecific degenerative involvement of the pigment epithelium. A certain loss of pigment granules which results in a more or less marked irregularity of the pigmentation of the pigment epithelium is a common finding in primary or secondary degeneration of the human eye. It is rather rare, however, to find such an advanced stage depigmentation as in some areas of this latter case. The significance of this finding is not understood. However, these areas of depigmentation had a part in forming the translucent parts of the ocular wall seen in Figure 1.

It is generally very difficult to evaluate the state of the peripheral choriocapillaris. However, it was our impression that the small blood vessels of the periphery of this eye were distinctly decreased in number and density of their arrangement. We found also advanced degenerative changes in some of these vessels and fibrosis of the larger vessels of the peripheral choroid. We believe that these changes of the blood vessels of the peripheral choroid must either be caused by or be part of the degeneration found in the peripheral pigment epithelium and retina.

The macroscopic examination already revealed that the vitreous in this case exhibited a late stage of degeneration and liquefaction. Only a ring-shaped layer of very dense vitreous which was firmly attached to the peripheral retina had remained. This layer was found to cover that zone of the retina

which exhibited the degenerative changes here demonstrated.

Histologically the vitreous was found to contain a dense meshwork of interconnected fibers which were impregnated with the silver carbonate method. These fiber structures were clearly seen to extend into the retina. These two histologic facts explain the dense structure of this layer of vitreous and its firm attachment to the peripheral retina.

The fact that the peripheral vitreous in the process of senile degeneration and liquefaction forms such "senile peripheral vitreoretinal adhesions" is well known, for example, from studies of Teng and Chi¹⁶ and Wadsworth.¹⁷

The existence of fibrils in the normal human vitreous is still under discussion.^{18,19} The relation of the present histologic finding of fiber structures in the vitreous to the so-called fibrous degeneration of the vitreous (Goldmann and others²⁰), as seen with the slitlamp, is not clear. It must be mentioned that Teng and Chi¹⁶ wrote about the senile vitreoretinal adhesion:

Histologically it exhibits a union between the hyaloid membrane of the vitreous and the internal limiting membrane of the retina. It seems to be cementlike in nature.

It is also of interest that Teng and Chi¹⁶ found the local vitreoretinal in contrast to these senile vitreoretinal adhesions to be fibrillar in character.

Cellular nuclei were found in the condensed vitreous of the present case. It is an

open question whether or not the cellular elements of these nuclei might be the same as the "hyaloideal cells" or "vitreous body cells" which were recently discussed by Szirmai and Balazs.²¹

The present histologic study shows new and old microscopic findings in the different tissues of the peripheral ocular wall which take part in what is ophthalmoscopically known as degeneration of the peripheral retina. The value of such a study is very limited, of course, in answering questions like: what causes what and where does it start? However, it may help to clear some of our ophthalmoscopic interpretations and stimulate further research.

SUMMARY

This study represents a demonstration of the histologic findings in the periphery of the left eye of a 70-year-old man that exhibited all changes of senile degeneration of the peripheral retina that we ever saw in human eyes. There were cystoid degeneration, obliteration of blood vessels, glia proliferation, and formation of very large hyaline bodies in the retina. The pigment epithelium exhibited complete and partial atrophy, depigmentation, local proliferation, and formation of hyaline drusen. The choriocapillaris was atrophic. The remnants of the degenerated vitreous showed dense fiber structures which were anchored within the tissues of the retina.

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A REVIEW OF FOUR HUNDRED CASES OF VERNAL CONJUNCTIVITIS*

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Although many papers have been published on the subject of vernal conjunctivitis, there are only a few publications that deal with large series of cases. In Israel this condition is prevalent and there was the opportunity to centralize in Jerusalem a great number of cases and to carry out detailed studies. It was hoped thereby to distinguish more particularly the relation of vernal conjunctivitis to focal infection, to allergy, and to endocrinopathy. Opportunity was also afforded for the study of the effect of the relatively new steroid therapy and in particular that of prednisone. In the course of the laboratory investigation, a new microtest for vernal conjunctivitis was developed, based on the presence of a mucopolysaccharide in the characteristic secretion.

METHODS

At the beginning of 1956, a research clinic for vernal conjunctivitis was set up in the Hadassah University Hospital, Jerusalem. Many cases from throughout the country were sent for investigation, and this accounts both for the large number of patients seen

during a relatively short period and the relatively high percentage of severe cases in the series.

The total number of cases was 400. Of these the first 220 were examined in 1956, and 180 additional cases were added to the series during the following year.

The diagnosis in each case was based on the history, the characteristic secretion, and above all on the objective condition of the conjunctiva during repeated examinations. If the typical changes of the conjunctiva were not seen, the case was not included in the series.

A careful history was taken from each of the first 220 cases with regard particularly to the following data: place of residence when the disease started, the seasonal variations of the condition, allergic antecedents, previous ocular and general disease. Also efforts were made to evaluate the family incidence of vernal conjunctivitis, of allergic conditions, and of chronic general disease.

A group of 60 patients was sent for an ear, nose, and throat opinion and a smaller group of 25 patients was sent to a dentist for search for possible foci of infection. X-ray films were taken whenever deemed necessary by the specialists concerned.

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TABLE 1
AGE AND SEX DISTRIBUTION

Age of Onset (yr.)	1-3	4-7	8-12	13-15	16-20	over 20
% of Males	8.5	20.0	24.5	8.0	7.0	4.5
% of Females	2.0	6.0	6.5	4.5	4.0	4.5
	10.5	26.0	31.0	12.5	11.0	9.0

Cultures from the conjunctiva were systematically taken from a large group of patients, and both bacteria and fungi were searched for.

Allergy skin tests were performed in a group of 40 patients. Desensitization courses were started in a small selected group.

On suspicion of endocrinologic disturbance, patients were sent to the endocrinology clinic for further evaluation. Various other investigations pertaining to endocrinology were carried out and will be discussed.

The chemical nature of the secretion was the subject of a special study.¹ Therapy and therapeutic studies were carried out in all patients. The results of prednisone therapy have been reported.²

CLINICAL ASPECTS

1. *The age and sex distribution* of the 400 patients is given in Table 1.

Total number of patients: 400.

Total number of males: 290 or 72.5 percent.

Total number of females: 110 or 27.5 percent.

2. *The duration of the disease* varied greatly, from several weeks to 28 years, the average being close to four years (table 2). There was no marked difference in duration between the sexes.

3. *Seasonal variations.* In 55 percent of the cases, there were symptoms during the summer months only. In 34 percent of the

cases, there were slight disturbances during the winter, too. In 11 percent, the seasonal variations were very slight, the condition persisting all year round.

It is interesting to note that during the first two years of the disease, there were marked seasonal variations in most cases and only later symptoms also appeared during the winter.

4. *Country of birth.* Of the 400 cases, 65.5 percent were born in Israel, 26 percent came from eastern countries or from North Africa, and 8.5 percent came from Europe. In only two percent of the cases the disease started abroad—Germany, Rumania, Iraq, and Iran. The disease often started within the first year of arrival in Israel. There were 21 countries of origin.

5. *Geographic distribution.* Two thirds of the cases were from the Jerusalem area, the remaining third coming from various parts of the country.

Data concerning place of residence did not reveal any significant variation in the incidence of the disease within the different parts of Jerusalem. It was natural to expect most cases to come from Jerusalem. There is no comparable investigation elsewhere in the country with whose findings comparison could be made. It is therefore impossible to evaluate the relative incidence of the disease in the different parts of the country on the basis of the information gathered up to date. It is worth mentioning that in general the

TABLE 2
DURATION OF THE DISEASE

Duration in Years	1	1-3	3-6	6-10	over 10
% of Patients	40	30	19	7	3

Jerusalem climate had a beneficial effect.

6. *Family incidence of vernal conjunctivitis.* This incidence was found to be high—28 percent. Moreover, in 15 cases there were more than two vernal conjunctivitis patients in the same family.

7. *Allergy.* Only 11 percent of the cases gave a history of some other allergic condition. The incidence of allergy, excluding vernal conjunctivitis, in the immediate families of the patients was 15 percent. These figures are not very different from those found in the general population.

Allergy skin tests were carried out by Dr. Gutmann in a group of 40 patients. The following materials were used:

1. Saline with 0.4 percent phenol as control skin test.
2. Mixed pollen extracts from local plants.
3. Standard extracts of fungi.
4. Bacterial allergen extracts.
5. Enteronase (a histamine derivative).
6. Hepar (liver extract 1/100).
7. Foodstuffs—fresh defatted milk (1/1000-1/100), meat (1/100), fish (1/100), egg white and egg yolk (1/100), wheat (1/100), potato (1/100), rice (1/100), peas, beans, onions, cacao.

Of each of the above materials 0.5 cc. was injected intracutaneously on the volar surface of the forearm. The tests were completed within three to four weekly sessions; five injections were given during each session. The results were read within half an hour of the injections. Results are shown in Table 3.

The total number of patients tested was 40, of whom 10 showed no reaction with any of the materials used.

In conclusion, a high incidence of positive skin tests to both bacteria and fungi were found, in 50 percent and 42 percent of the

cases, respectively. When compared with normal control groups, these results are significant, since the incidence of positive skin tests to bacteria or fungi does not exceed 10 percent (M.J.G.).

8. *Foci of infection and general pathology.* Histories concerning antecedent ocular and general disease of both patients and their families did not reveal any significant facts except for ear, nose and throat pathology. The majority of the patients complained on inquiry of some chronic ear, nose and throat disturbance. Sixty patients were examined and objective signs of a chronic pathologic process were found in 40. The most common diagnoses were chronic rhinitis and vasomotor rhinitis. Other findings included: sinusitis (seven cases), adenoids (seven cases), chronic tonsillitis (five cases), otitis media (five cases), and recurring anginas, laryngitis and pharyngitis in a smaller number of cases. This incidence of chronic ear, nose and throat pathology is significantly higher than in unselected similar age groups.

Twenty-five dental examinations revealed only one possible septic focus. Four other patients required some minor dental care.

9. *Bacteriologic study.* Cultures from the conjunctiva were taken systematically from a group of 50 patients. The media used were: (1) Brain-heart, (2) blood agar, (3) Loeffler, (4) MacConkey, (5) Loewenstein.

Only one of the 50 cultures proved to be sterile. In the others there was growth of the following organisms: *B. sporogenes* (5), *B. alcaligenes* (4), *Pneumococcus* (1), *Klebsiella* (2), *Streptococcus anhemoliticus* (2), *Corynebact. hoffmannii* (11), *Corynebact. xerose* (7), *Staphylococcus aureus* (6), *Staphylococcus albus* (30), *Neisseria catarhalis* (1).

These results show that pathogenic bac-

TABLE 3
RESULTS OF THE STUDY

Materials	Pollen	Fungi	Bacteria	Fungi and Bacteria	Foodstuff	Other
No. of Positive Reactions	3	17	20	9	3	0

teria grow in a small percentage of cases only and that they have no causal significance for this disease.

In order to determine the role of fungi in vernal conjunctivitis, 30 cultures from the conjunctiva were sent to the Mycological Laboratory of the Hadassah Hospital. Results were negative in all.

10. *Endocrinology.* Over 72 percent of the cases were in males. However, if we consider the incidence of the disease for both sexes, before and after puberty, we find that there were proportionally less female patients in the younger age groups. There were 73 percent of the males under the age of 13 years, whereas only 54 percent of the females were under this age. In order to explain the sex incidence of vernal conjunctivitis which is even more marked in other reports,³⁻⁵ the following examinations were performed:

1. Whenever there was suspicion of an endocrinologic disorder, the case was sent to the endocrinology clinic for evaluation. Marked disturbances of this nature were found in seven percent of the cases. The diagnoses were cryptorchidism, delayed puberty, obesity, and hirsuties. The more minor endocrinopathies were not included since it is difficult to assert where such pathologic alterations begin. We were thus unable to confirm the very high percentage of endocrinopathies that is sometimes encountered in the literature. (Solanes,⁶ 1942, 30 percent; Fierro del Rio,⁷ 1947, 67 percent). However, the incidence of disorders of this nature in similar age groups is estimated to be about two percent and, therefore, our findings are of significance.

2. The Thorn test was performed in 10 unselected patients, without obvious endocrinopathy. The results generally showed low responses but a greater number of tests is required.

3. Determinations of 17-ketosteroids, corticosteroids, and total estrogens in the urine were carried out in three cases, two boys and a girl, in whom there was no obvious endocrinopathy. The results were within normal limits.

4. On the assumption that in vernal conjunctivitis we may be dealing with an allergy to hormones (Zondek and Bromberg, 1945, 1947^{8,9}) the conjunctiva was tested with aqueous solutions of one-percent estradiol, estron, and testosterone. One-percent cholesterol was used as a control. One drop of each solution was put into the conjunctival sac of 20 patients. There were no reactions in any of the patients.

11. *The secretion.* It was considered possible that some mucopolysaccharide may account for the stringy character of the secretion in vernal conjunctivitis. Since the quantities of conjunctival secretion are usually minute, it was necessary to resort to a new microtest for mucopolysaccharides (Blumenkrantz,¹⁰ 1957). Conjunctival smears were taken from 150 cases suffering from vernal conjunctivitis and as controls from 50 normal eyes and from 50 various other conjunctival conditions.¹ These smears were suspended in a drop of distilled water and a drop of toluidine blue 0.1 percent was added.

Under the microscope the precipitate formed was considered "positive" when it consisted of granular fibers or particles colored violet (metachromasia). This precipitate was similar in color and morphology to that obtained when toluidine blue was added to pure hyaluronic acid. Results were considered "negative" when there was very little precipitate which was practically all blue, and "atypical" when there was abundance of a granular precipitate which was also blue, not metachromatic.

All smears taken from vernal conjunctivitis cases were found to be positive. All the smears taken from the normal conjunctivas were either negative or atypical. Of the 50 various conjunctival conditions only five were found to be positive.

These results indicate a fairly specific test for vernal conjunctivitis based on the presence of a mucopolysaccharide in the secretion. It is more specific than the provocative tests for the appearance of the characteristic secretion or than the local presence of eosinophiles.

12. *Clinical types.* Of the 400 cases 35 percent were classified as light, requiring little treatment; 27 percent were considered as moderate and required continuous treatment for at least several months each year. The remaining 38 percent were severe. In most of these cases there was often corneal involvement with persistent photophobia.

The palpebral changes were more manifest than the limbal ones, but slitlamp examinations revealed that the majority of cases were of the mixed variety, and often during the period of observation cases changed from one variety into another.

13. *Complications.* The most important complication was corneal ulceration which appeared in 3.25 percent of the cases. In a number of these the ulceration was bilateral. All the ulcerations had a torpid course unless prednisone was given orally. With this form of medication healing was complete within a week or two. Relapses were common at the site of the former ulcers. It is noteworthy that this complication occurred usually in children in whom the age of onset of vernal conjunctivitis was remarkably low.²

In addition to the above there were two percent with nebulas or maculas of the cornea as the result of previous ulceration. There was no trachoma in these cases. Advanced pannus was found in one percent of the cases, all of which were also free from trachoma. Trachoma was found in five percent but only in two cases was the disease active.

There was temporary ptosis of the upper eye lid in three percent. There were three cases with keratoconus or keratoglobus, and three more cases with advanced pseudogerontoxon.

14. *Therapy.* Various forms of treatment were employed, including the topical use of antibiotics and the three steroids—cortisone, hydrocortisone and prednisone.

One hundred cases received prednisone therapy, the majority during two consecutive

years.² Prednisone was given in the form of Metimyd eye drops three to five times daily and less frequently when the condition improved. Twenty-five of the patients were also given short courses of prednisone by mouth. A comparative therapeutic trial with cortisone, hydrocortisone and prednisone was carried out in a group of 30 patients. Prednisone was found to be superior to all other forms of therapy. It did not cure the condition but was most effective in its management. There was marked diminution of itchiness and photophobia. Objectively there was less secretion, the vegetations lost their redness, became pale, progressively flatter and sometimes completely disappeared. Prednisone by mouth was especially valuable in severe cases and more so if corneal ulceration was present.

Beta strontium irradiations were used in a group of 12 selected patients with severe palpebral involvement. The source was applied directly on the everted upper eyelid; 1,000 rep were given three or four times over weekly intervals. All the irradiations were carried out on one eye only, the relative condition of both eyes having been previously noted. There were no appreciable effects in all cases thus treated.

DISCUSSION

This study of 400 cases of vernal conjunctivitis has helped perhaps to clarify various aspects of this condition on which there is doubt and diversity of opinion.

Over 80 percent of the patients were under the age of 15 years, thus confirming the fact that vernal conjunctivitis is essentially a disease of youth. The very early onset of the condition, below the age of three, in over 10 percent of the cases is of special interest since this group proved to be most susceptible to corneal ulceration.

Almost three fourths of the cases were in males. There were relatively more females beyond the age of puberty, and beyond the age of 20 years there were as many males

as females. The average duration of the disease was close to four years and did not vary appreciably between the sexes. The relation of sex and puberty to vernal conjunctivitis formed the basis for an endocrinologic study. A high incidence of endocrinopathies was found and possibly a low response to the Thorn test. Thus the role of endocrine imbalance in vernal conjunctivitis is emphasized.

There were marked seasonal variations in 55 percent of the cases. With few exceptions all these cases were light or moderate at most. The majority of the severe cases suffered from their condition during the whole year although they were also sensitive to changes in weather. Undoubtedly some weather conditions such as temperature and possibly relative humidity play an important role in aggravating both signs and symptoms. However, in Israel at least, the name of the condition is misleading since it is not confined to the spring only, nor is there any evidence that there is an etiologic seasonal factor at play.

The incidence of vernal conjunctivitis in the Middle East is known to be one of the highest.¹¹ In Israel where more than half the population came from abroad within the last 10 years all groups proved to be equally susceptible to this condition, and less than two percent developed the disease abroad. The condition often started within the first year of arrival in Israel.

The personal and family incidence of allergy in patients with vernal conjunctivitis was not significantly higher than in the general population, when vernal conjunctivitis was excluded from the family history and when ear, nose and throat pathology was not considered. This is in contradiction to the generally accepted view on the subject but it confirms the more recent report of Puig Solanes⁶ whose figures come very close to our own. The skin tests, on the other hand, showed a remarkably high percentage of

positive reaction to bacteria and fungi. It would appear, therefore, that the vernal conjunctivitis patient is in some way "hyper-sensitive," although there is no evidence up to date of any particular allergen that would cause this disease.

The results of the general investigations showed that foci of infection certainly did not play an important role in vernal conjunctivitis. There was no connection between vernal conjunctivitis and general disease. The very high incidence of ear, nose and throat disturbance, mainly chronic vasomotor rhinitis, probably suggests a common etiologic background, which would include allergy.

The stringy character of the secretion in vernal conjunctivitis is probably due to the presence of a mucopolysaccharide. This constitutes the basis for a new diagnostic micro-test for vernal conjunctivitis.

Prednisone was found to be the most effective drug for vernal conjunctivitis and especially for any complicating corneal ulceration. There was no evidence of complete cure with this therapy and relapse were the rule when therapy was stopped.

SUMMARY

A review is given of 400 cases of vernal conjunctivitis.

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CATARACT CASES LOST BEFORE SURGERY*

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An unfortunate outcome following cataract extraction is often directly attributable to pre-existing difficulties. I should like to emphasize that these are usually preventable complications. The causes of preventable complications may be listed as: (1) Infectious, (2) allergic, (3) degenerative, (4) traumatic, (5) congenital, (6) neoplastic, (7) systemic, and (8) psychologic.

1. INFECTIOUS

A large proportion of postoperative infections are believed to arise from bacteria pre-existing about the eye.

a. *Chronic dacryocystitis* is one of the more common sources of postoperative infection. A careful check for regurgitation from the lacrimal sac is mandatory in the preoperative evaluation of the patient. An adequate check for regurgitation requires an uncomfortable degree of pressure directed to

the lacrimal fossa behind the orbital rim—not on the side of the nose. Routine lacrimal irrigation is probably unrewarding. Presence of epiphora demands careful and thorough investigation.

b. *Chronic marginal blepharitis* may easily be recognized by its characteristic scaling and matter on the lid edges. Such conditions should be eradicated preoperatively by hot compresses, mechanical cleansing, and antibiotic ointments. Special attention should be paid to patients with neurodermatitis who tend to have persistent skin infections.

c. *Acute infections* such as conjunctivitis, hordeolum, cellulitis, and so forth, require postponement of elective intraocular surgery.

d. *Routine cultures of the conjunctival cul-de-sac* are carried out at some clinics. If such a policy is adhered to, cultures should be done far enough in advance to permit laboratory reporting of culture results preoperatively. Most ophthalmologists use the simpler method of routine prophylactic topical antibiotics, instilled repeatedly for at least a day preoperatively. Statistical evidence in-

*From the Department of Ophthalmology, The Ohio State University School of Medicine. Presented before the Ohio State Medical Association, April, 1958.

icates that such prophylactic treatment will reduce the incidence of operative infection.

e. *Sterilization.* It is apparent that constant attention must be paid to maintain sterility of all details of the operative procedure, including preparation of the patient, the instruments, and the surgeon's hands.

2. ALLERGIC

a. *Uveitis.* Dispute exists as to whether uveitis is allergic or infectious. Undoubtedly both types exist.

Since severe uveitis may result in formation of a cataract, the problem of operating on such eyes is not infrequent. Iridocyclitis of this severity will often persist as a low-grade inflammation for many months. The trauma of surgery will almost invariably increase the severity of such a smoldering uveitis. The result of ill-timed surgery may be a chronically inflamed eye, with progressively increasing vitreous opacities and ultimate phthisis. If possible, surgery on eyes having suffered from uveitis should be deferred until all evidence of activity (such as limbal flush, aqueous flare or cells, vitreous cells) has been completely absent for at least several months.

Steroid therapy, both systemic and topical, in high dosage, is desirable pre- and post-operatively in patients who have had severe uveitis. Wound healing is not retarded to a clinically detectable amount by such steroid therapy. Especial attention should be given to maintaining good postoperative mydriasis in these cases.

There is a high incidence of macular damage in cases of uveitis severe enough to cause cataract formation. Direct destruction of the fovea by a focus of chorioretinitis usually produces an extensive and absolute central scotoma. The macula is susceptible to insidious destruction in cases of extensive peripheral uveitis. This destruction appears variously as macular hard exudates, pigmentary irregularity, or (most commonly) as an irregular glistening sheen which probably represents formation of a preretinal

membrane. Should extensive macular damage be present, postoperative vision will usually be unsatisfying to both patient and surgeon. Effort should be made to discover such complications before surgery is recommended. Reference to previous records of your own or other physicians is helpful.

At this point, I would like to recommend the Schepens binocular indirect ophthalmoscope. With this instrument, if the pupil can be widely dilated, it is possible to see clearly details which are entirely hidden from the direct ophthalmoscope. In general, if the disc is even barely visible with the direct ophthalmoscope, the indirect ophthalmoscope will provide a view clear enough to diagnose or exclude macular disease. The Schepens ophthalmoscope is useless if the pupil cannot be dilated. Considerable practice is required to gain proficiency in its use; nevertheless, this instrument is invaluable in the study of the optic nerve and retina behind a moderately dense cataract.

The operative procedure itself is modified by the residual scars of old uveitis. Posterior synechias seriously complicate lens delivery and must be completely freed with a spatula before attempting extraction. Following severe iritis with extensive posterior synechias, the pupil margin may become densely fibrotic and unyielding. This renders a round pupil extraction impossible. Either a complete iridectomy or a radial cut including the pupil is effective. If the pupil is quite small and fibrotic, a radial sphincterotomy at the 6-o'clock position, done before lens delivery, will produce a better opening post-operatively.

Pre-existing glaucoma due to a pupil-block mechanism is eliminated by cataract extraction. Pre-existing inflammatory angle-closure glaucoma may require a filtering operation before cataract extraction. The problems of a postoperative flat chamber discourage most ophthalmologists from combining cataract extraction and a filtering procedure in these cases.

b. *Drug allergies* are common and should

be discovered in the preoperative history. Prophylactic use of penicillin or sulfonamide must be avoided in patients allergic to these medications. Known atropine allergy will invariably recur with renewed use. Mydriasis may be maintained by neosynephrine and Cyclogyl instilled several times daily. Prolonged mydriasis equivalent to that of atropine is produced by one-percent Antrenyl (Ciba). Antrenyl is a synthetic parasymphatholytic mydriatic which is chemically entirely different from atropine and does not cause an allergic response in atropine-sensitive patients.

3. DEGENERATIVE

a. *Detection of the early stages of Fuchs' endothelial dystrophy* is one of the rewards of careful slitlamp examination. By the use of specular reflection, the characteristic rounded, glistening grayish Hassall-Henle bodies may easily be recognized. Inasmuch as the corneal condition often is much worse following surgery, the decision to do cataract extraction should be deferred as long as possible. It is said that a scleral incision is preferable to a corneal incision in these cases. Use of an erisophake may excessively damage the endothelium.

b. *Chorioretinal degenerative changes* accurately predict a much higher incidence of aphakic retinal detachment. Most of these conditions are more extensive peripherally than centrally, and associated macular damage ordinarily indicates severe peripheral cystic degeneration. This is particularly true of myopic degeneration. Two excellent reasons exist to postpone cataract extraction as long as possible in the presence of chorioretinal degeneration. First, there is a high incidence of retinal detachment of a type which often leads to total blindness despite treatment; and second, macular damage may preclude good central vision postoperatively.

c. *Senile macular degeneration* in its many forms is well known to us all. This is usually dependent on, or more severe than, the chorioretinal degenerations already de-

scribed. Its high incidence requires careful examination of the macula, if possible, in all patients being evaluated for cataract surgery. The greatest problem is presented by the purely neuroepithelial type of senile macular degeneration in which visual loss is great and ophthalmoscopic findings are minimal. The critical decision in these instances is whether the degree of blurring of the fundus view obtained by the direct ophthalmoscope is compatible with the amount of visual loss. A clear fundus view is irreconcilable with 20/100 vision. Confirmation of the diagnosis of macular degeneration may be obtained through perimetric demonstration of a central scotoma.

Removal of an early cataract in the presence of senile macular degeneration will not improve vision and imposes upon the patient the problems of aphakic vision. Such patients are invariably unhappy. Removal of a dense cataract will restore peripheral vision which may be most helpful to the patient. He should be told preoperatively that he must not expect central acuity.

d. *Optic atrophy* necessitates a most guarded prognosis. Obviously surgery is not indicated in the absence of light perception, or if it is known that vision was not useful prior to development of the cataract. Inasmuch as central vision may be spared by the concentric constriction or sector defects of neuro-ophthalmologic types of optic atrophy, and by the arcuate defects of glaucoma, careful individual consideration should be given to removal of fairly dense cataract despite the presence of partial optic atrophy. A special case is the consecutive atrophy of retinitis pigmentosa, which may be compatible with good central vision after removal of the complicated cataract.

e. *Neovascularization of the iris* is an extremely bad sign usually indicating the presence of severe retinal destruction behind the cataract, and promising hemorrhagic surgical complications. The common causes are occlusion of the central retinal vein and diabetic retinitis proliferans. Rarely will the

patient benefit from cataract extraction under these conditions. Dilatation of the iris vessels in association with uveitis, phakogenic irritation, or telangiectasia is less indicative of posterior ocular damage.

f. *Known retinal detachment* behind a dense cataract would require a heroic series of operations to restore vision—if possible at all. Usually it is doubtful whether operation is justified, especially if the other eye is good. Detection of such a lesion is one of the reasons for checking light projection of the cataractous eye. (One should be aware that light projection is often faulty in a mature cataract with no retinal disease, and that such a finding alone does not contraindicate surgery.)

4. NEOPLASTIC

a. *Advanced malignant melanoma* may cause cataract, and should be considered in the differential diagnosis of spontaneous unilateral cataract. Usually such melanomas will be so far advanced that the eye is either totally blind or has suffered extensive field loss. Dilated large vessels without capillary dilatation overlying a sector of the sclera, or pigmented extensions through the scleral foramina are strongly suggestive of malignant melanoma. Glaucoma may be present; however, it is notable that one third of eyes with melanoma which have been enucleated had subnormal tension.

b. *Choroidal detachment* occurs frequently after cataract extraction and is characteristically associated with a shallow anterior chamber. These detachments are globular, like a melanoma, but are of much darker color. Eyes have been mistakenly enucleated when a large choroidal detachment is first seen after removal of a very dense cataract.

5. CONGENITAL

a. *A short palpebral aperture* may lead to inadequate exposure and difficulty with surgical manipulations. Much of this difficulty may be avoided by a simple lateral canthotomy when beginning surgery. A single

lateral scissors snip will nicely widen the aperture. Suturing of this incision post-operatively is optional.

b. *Suppression amblyopia* is ordinarily considered to be an acquired phenomenon, but is secondary to inherited defects. Two thirds of these cases are associated with strabismus and one third with anisometropia. Inasmuch as about two percent of the population is said to have suppression amblyopia of 20/200 severity, it is important to ask the patient, "were both eyes good before you developed cataract?" This question is particularly important if the patient has obvious strabismus, scars of extraocular muscle surgery, or a history consistent with strabismus in childhood. Such a question will also pick up cases of monocular decreased vision due to other causes. A study done during the recent war disclosed that five percent of the draftees had uncorrectible vision in one eye of 20/200 or less. Knowledge of such a defect will frequently greatly alter one's recommendations for cataract surgery.

6. TRAUMATIC

a. *The presence of old injuries* affecting the posterior part of the eye is detected through a history of defective vision preceding onset of cataract or by fundus examination if possible. The differential diagnosis of unilateral cataract should include a strong suspicion of trauma. Slitlamp evidence of a scar in Descemet's membrane is proof of penetrating injury. Often X-ray studies may be indicated to rule out a tiny intraocular foreign body. Management of these cataracts depends upon the extent of associated damage.

b. *Self-inflicted injuries* may occur at the time of surgery or during subsequent weeks. Although these injuries are usually dismissed as the patient's fault, they do not enhance the physician's reputation; and, indeed, he can prevent many such accidents. All patients should be clearly aware of the delicateness of a recently operated eye. They must be impressed with the necessity of avoiding pres-

sure on their eye and excessive physical activity. The patient who cannot co-operate in office examination is not a candidate for local anesthesia. If one cannot do a tonometer tension on the patient, one cannot extract his cataract under local anesthesia. Language barriers, deafness, and mental deficiency are absolute indications for general anesthesia if the patient is to be kept from damaging his own eye. Additional sutures are indicated if the patient may be restless and unco-operative postoperatively. If barbiturate premedication is to be used, a test dose the night before surgery will eliminate unforeseen toxic mental reactions. Excessive sedation may put the patient to sleep which is undesirable because he may awaken suddenly and move at a critical point during surgery.

A chronic pulmonary cough should be brought under control with antibiotic aerosols, steam inhalations, antitussives, and so forth before performing intraocular surgery. The cardiac with cough and orthopnea should be digitalized and dehydrated. An incipient prostatic obstruction should be corrected before eye surgery. The mental patient should have psychiatric clearance. Do not shock your diabetics with full insulin dosage despite skipping a meal. Treat constipation with whatever routine the patient prefers.

By such measures the majority of patient-inflicted injuries may be prevented. Do not neglect the relief of postoperative pain through analgesics and reassurance.

7. SYSTEMIC

Many of these conditions have already been discussed from the aspect of minimizing injury to the operated eye. One should avoid the use of adrenalin in local anesthesia administered to a patient with coronary

artery disease. Avoidance of excessive concentrations and amounts of local anesthetic and of accidental intravenous injection will minimize the possibility of fatal reaction to local anesthesia. Barbiturate premedication raises the threshold for such toxic reactions. Early ambulation reduces the possibility of thrombo-embolism.

Do not neglect the continuance of essential routine medications upon which the patient is dependent!

8. PSYCHOLOGIC

In spite of a perfectly executed and uncomplicated cataract extraction, the patient may be most dissatisfied and a trial to his doctor. This is most likely to occur if some other ocular defect prevents good central vision—emphasizing the importance of thorough preoperative evaluation. Aphakic vision is beset with many annoyances and is acceptable to the patient only after he has himself recognized the inadequacy of his cataractous vision. Recognition of this is shown in the maxim "don't operate until the patient cannot do what he wants to do." Premature cataract extraction may produce a very unhappy patient who resists becoming adjusted to his glasses. Extraction of a monocular cataract often does not make a satisfied patient.

Many such psychologic problems will not have been encountered if the date of surgery is postponed.

SUMMARY

Predictable disappointments following cataract extraction are to be expected if surgery is undertaken prematurely or without adequate evaluation for associated ocular defects.

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ATARACTIC AND ANTIEMETIC DRUGS IN CATARACT SURGERY*

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Chlorpromazine has been shown to have a potent ataractic effect on apprehensive, tense, anxious patients and minimizes the incidence of severe nausea and vomiting during and following cataract surgery¹ under local anesthesia. Drugs possessing such qualities should be useful in ophthalmic surgery.

Since our original report in 1957, the use of chlorpromazine has been studied in an additional 100 cataract extractions. In this recent series the drug has been given in a modified dosage schedule at regular prescribed intervals and for a longer period of time. Following the original report our experience indicated that the incidence of nausea and vomiting could be further reduced with an improved dosage pattern.

Two other phenothiazine derivatives, prochlorperazine (Compazine®) and perphenazine (Trilafon®) were investigated in a series of 50 consecutive cataract extractions and compared with a control group. These drugs were chosen because they are chemically related phenothiazine derivatives and reputedly potent ataractic and antiemetic agents.

HISTORICAL DATA

Chlorpromazine was first used by French investigators for surgical cases in 1951. Subsequently, the clinical application of chlorpromazine was studied elsewhere on the continent and in Great Britain. The drug was introduced to the United States in May, 1954. In the brief period of two years it is estimated that it has been administered to over

seven million patients. A rapidly growing bibliography on this drug indicates that it has usefulness in the treatment of nausea and vomiting, mental and emotional disturbances, alcoholism, intractable pain, protracted hiccoughs, obstetrics, asthma, neurodermatitis, and in drug addiction for symptoms after withdrawal.

It would appear to be a valuable drug for pre- and postoperative medication in ocular surgery. Becker² reported first in the ophthalmic literature of this country that the therapeutic administration of Thorazine® to adults in doses of 50 mg. intramuscularly and 24 mg. orally every four to six hours alleviated dramatically all instances of nausea and vomiting following surgery on the eye. However, Hanno³ warned against the indiscriminate use of chlorpromazine on a routine basis until the drug has had a more critical evaluation. He refers to the complication of intrahepatic biliary obstruction and one death with jaundice reported in the English literature. According to Hanno, vomiting is a rare postoperative complication at Wills Eye Hospital due to attention to these factors: (1) use of Demerol and barbituates rather than morphine, (2) local anesthesia rather than general, and (3) early attention to postoperative abdominal distention.

PHARMACOLOGY

Chlorpromazine which chemically is a 10-(3 dimethylaminopropyl)-2-chlorophenothiazine has a varied pharmacologic effect. According to Nutt and Wilson⁴ it is capable of initiating the following: (1) production of sleep as a tranquilizer and general lowering of the metabolic rate, (2) potentiation of the action of other analgesics and anesthetic drugs, (3) depressant effect on the vomiting

* From the Department of Ophthalmology, Temple University School of Medicine, Philadelphia. Read at the 94th annual Meeting of the American Ophthalmological Society, White Sulphur Springs, West Virginia, May 28-30, 1958.

centers, and (4) some reduction in muscular tone and a probable antiadrenalin effect. It is believed that chlorpromazine acts principally on higher neural centers in the general area of the diencephalon selectively inhibiting the chemoreceptive emetic trigger zone, the hypothalamus, and the reticular substance. These centers are believed to control vomiting, heat regulation, wakefulness, vasomotor and muscle tone. Large doses of chlorpromazine may depress the medullary emetic center directly.⁵

Prochlorperazine is 10-[3-(1-methyl-4-piperazinyl)-propyl]-2-chlorophenothiazine. On the basis of weight it is approximately three to four times more effective than chlorpromazine.

Perphenazine is [10-3-1-(2-hydroxyethyl)-4-piperazinyl-propyl]-2-chlorophenothiazine.⁶ Upon oral administration, the milligram potency of perphenazine is estimated between five and 10 times that of chlorpromazine.

There appears to be at least two mechanisms for emesis. The nausea and vomiting caused by circulating emetic agents are produced by indirect stimulation of the vomiting center by way of the chemoreceptive emetic trigger zone and can be controlled by antiemetic agents. Motion sickness is believed to operate in a similar manner. However, the nausea and vomiting induced by gastrointestinal factors, sights and smells are the result of direct activation of the vomiting center.⁷ The chemoreceptive emetic trigger zone is bypassed and clinical antiemetic agents are less effective.

Since these drugs are all phenothiazine derivatives and chemically related their pharmacodynamic action is probably similar although the ataractic and antiemetic effectiveness may vary. There seems to be no correlation between antihistaminic potencies.⁸

It is understood that "the A.M.A. Council on Drugs has voted to abandon the section on ataractics in *New and Nonofficial Drugs* and to describe agents proposed for use for their particular effects on the central nervous system, in accordance with their fundamental pharmacologic classification. . . .

"Drugs in this general category will be classified hereafter under four general headings: antihistamines, central nervous system depressants, central nervous system stimulants, and miscellaneous agents."

REVIEW OF LITERATURE

Insofar as can be determined there have been at least 1,383 reports on chlorpromazine in the medical literature throughout the world. Many of the articles stress the antiemetic and ataractic qualities of the drug but there has been a relative paucity of material dealing with ophthalmic surgery. Nutt and Wilson⁹ describe their experiences with 80 surgical cases including cataract extraction, glaucoma, and corneal grafting operations. They stress the chief advantages as (1) no co-operation is required from the patient during surgery or immediately postoperatively, (2) it produces a low-tension eye, ideal for surgery and (3) the recovery period is restful and quiet.

Moore¹⁰ discussed a series of 58 eye surgical patients who received chlorpromazine as premedication and stated that "barbituates given alone may make a patient drowsy to the point of sleeping but do not diminish the fear of and reaction to the pain produced by the necessary injections, nor do they allay preoperative anxiety." He found, however, that "the patient's nervousness may be lessened" by the oral use of this drug and thought that chlorpromazine (Largactil) produced a calmer, more relaxed, and co-operative patient.

The use of chlorpromazine in ocular surgery in 22 psychotic and 23 nonpsychotic patients who have undergone major ocular surgery has been studied and reported by Byerly, Murray, Winter, and Vitols.¹¹ Preoperatively chlorpromazine was found to calm and relax the patient, reduce anxiety and apprehension, and lessen the amount of sedation and analgesia required. During surgery the drug reduced restlessness, controlled vomiting, and enhanced anesthesia. Postoperatively, in conjunction with small doses of analgesics or sedatives, it relieved pain,

and controlled nausea, vomiting, hiccoughs, and confusion.

The experience of Burn, Hopkin, Edwards, and Jones¹² in Great Britain has been similar. In 89 patients under local anesthesia a combination of chlorpromazine, promethazine, and pethidine gave unquestionable improvement as noted by the absence of apprehension or tenseness, greater muscular relaxation, and minimal bleeding. The authors were impressed by the advantage over barbituate sedation alone.

Following general anesthesia it has been estimated by Albert and Coakley¹³ that nearly 25 percent of the patients develop distressing postanesthetic vomiting. These authors report that the oral administration of 50 mg. of chlorpromazine preoperatively reduced the incidence of vomiting after general anesthesia by 50 percent.

Fritz¹⁴ reports on the use of chlorpromazine in 25 cases under local anesthesia involving the eye, nose, and throat. There was no nausea, vomiting, or anxiety. Somnolence was pronounced and amnesia noted frequently. No complications attributed to the drug were noted.

Paul and Leopold¹⁵ found that systemically administered chlorpromazine lowered intraocular pressure in experimental animals. This adds support to a similar observation on the human eye and indicates a probable side advantage of this drug for intraocular surgery.

Reports on the two newer phenothiazine derivatives, prochlorperazine and perphenazine, have begun to appear in medical publications. The drugs are being used particularly in the field of psychiatry. There have been few references to the use of these medicines in ophthalmic surgery. King¹⁶ states that Thorazine or Trilafon administered postoperatively are safe and useful in preventing or treating nausea following cataract surgery. He cautioned about the potentiating actions these drugs have in conjunction with sedatives and analgesics.

In a group of patients, aged 60 to 80 years, with psychic disturbances of varying se-

verity, perphenazine was rapidly active and therapeutically effective with a minimum of side-effects. From a total of 19 patients, 15 improved within three to seven days.¹⁷

With nonspecific vomiting Trilafon was classed as excellent in 54 of 59 patients. There were three cases in which the drug was not clinically effective.¹⁸

Prochlorperazine was administered to 70 agitated geriatric patients with an effectiveness of 77 percent.¹⁹ It appears to be a safe and effective therapeutic agent for the relief of geriatric agitation whether from a primary emotional source or secondary to somatic disease.

Prochlorperazine was found most effective of a series of phenothiazine derivatives for inhibiting emesis in drug-induced vomiting. Boyd,²⁰ and Friend and McLemore²¹ reported on the effectiveness of prochlorperazine in 25 cases of nausea and vomiting of various etiologies. On long-continued therapy mild gastric irritation may occur. Higher doses may cause confusion, dizziness, and fainting. No jaundice or agranulocytosis or other serious toxic effects were observed.

MATERIAL, DOSAGE AND TECHNIQUE

The first 100 consecutive cataract extractions had the following preoperative routine: sodium pentobarbital (Nembutal®) 100 mg. the evening preceding surgery, nothing by mouth four hours preoperatively, sodium pentobarbital 100 mg. four hours preoperatively, and sodium pentobarbital 100 mg. one hour preoperatively, meperidine (Demerol®) 50 to 100 mg. according to weight and age, and demenhydrinate (Dramamine®) 50 mg. one half hour preoperatively. Postoperatively: meperidine 50 mg. every four hours, as required for pain, or aspirin 600 mg. was prescribed.

The second 100 consecutive cataract extractions had the identical preoperative orders with the addition of chlorpromazine 25 mg. orally one-half hour preoperatively. Chlorpromazine 25 mg. was given parenterally immediately postoperatively and again

TABLE 1
FREQUENCY OF NAUSEA IN 300
CATARACT EXTRACTIONS

	Minimal Nausea	Severe Nausea	Total
No thorazine control	16	11	27
Thorazine first series	16	3	19
Thorazine second series	7	1	8

every three hours if required for the control of nausea or vomiting.

The third 100 consecutive cataract extractions had the identical preoperative orders as the second 100 consecutive cataract extractions. Chlorpromazine 25 mg. was given parenterally immediately postoperatively and repeated every six hours for eight doses in the third 100 consecutive cataract extractions.

The preoperative and postoperative routine was further revised after the 35th case for patients 65 years of age and older. This older age group had the following preoperative routine: sodium pentobarbital (Nembutal®) 100 mg. the evening preceding surgery, sodium pentobarbital 50 mg. four hours preoperatively, sodium pentobarbital 50 mg. one hour preoperatively, meperidine (Demerol®) 25 to 75 mg. according to weight and age and demenhydrinate (Dramamine®) 50 mg. one-half hour preoperatively. Postoperatively: meperidine 25 to 50 mg. every four hours as required for pain, or aspirin 600 mg., was prescribed. Chlorpromazine 25 mg. was given parenterally immediately postoperatively and repeated every six hours for eight doses.

Two additional series, consisting of 25 cases each, were observed in which other phenothiazine derivatives were used. The

TABLE 2
FREQUENCY OF VOMITING IN 300
CATARACT EXTRACTIONS

	Minimal Vomit- ing	Severe Vomit- ing	Total
No thorazine control	10	8	18
Thorazine first series	5	3	8
Thorazine second series	1	1	2

TABLE 3
FREQUENCY OF NAUSEA IN 75 CATARACT EXTRACTIONS
EACH SERIES = 25 CASES

	Minimal Nausea	Severe Nausea	Total
Control	3	2	5
*Prochlorperazine (Compazine®)	2	0	2
*Perphenazine (Trilafon®)	4	0	4

fourth series of cataract extractions received the identical preoperative and postoperative orders except that prochlorperazine 10 mg. (Compazine®) was substituted for chlorpromazine. In the absence of untoward symptoms this drug may be used in the form of spanules every 12 hours to provide a sustained therapeutic effect.

The fifth series of cataract extractions were provided with perphenazine 4.0 mg. (Trilafon®). The other preoperative and postoperative medication remained identical.

All five series were subjected to the identical technique in each instance. The procedure included the preparation of a limbal-based flap and two preplaced grooved 6-0 chromic gut sutures. Delivery of the lens was accomplished with an erisophake or a capsule forceps. All cases were done under local anesthesia using two-percent procaine for akinesia by the O'Brien and Atkinson method and the retrobulbar block.

RESULTS

The quantitative and qualitative measurement of ataractic effects of these phenothi-

TABLE 4
FREQUENCY OF VOMITING IN 75 CATARACT
EXTRACTIONS
EACH SERIES = 25 CASES

	Minimal Vomit- ing	Severe Vomit- ing	Total
Control	0	2	2
*Prochlorperazine (Compazine®)	0	0	0
*Perphenazine (Trilafon®)	2 preop. 1 postop.	0	3

TABLE 5
USE OF CERTAIN PHENOTHIAZINE DERIVATIVES
IN CATARACT SURGERY

	Ataractic Effect	Antiemetic Effect
Chlorpromazine (Thorazine®)	Excellent	Good
Prochlorperazine (Compazine®)	Good	Excellent
Perphenazine (Trilafon®)	Good	Fair No severe emesis

azine derivatives does not lend itself easily to calibration and one must rely on clinical observation and patients' statements.

In the third series of 100 operative cases in which chlorpromazine was used preoperatively, postoperatively, and every six hours for eight doses only seven patients exhibited any anxiety, apprehension, or tenseness during surgery or in the immediate postoperative period. The remaining 93 were well sedated and exhibited no evidence of anxiety. This represents an improvement of 13 percent in the ataractic effect when using chlorpromazine as compared to the control series. One patient was so sedated that she lost consciousness for over four hours and required oxygen and vasopressor drugs to revive her. A number of the patients slept during surgery but could be easily aroused. When patients on the operating table appear too alert and tense, it has become a routine practice to give an additional small dose of the ataractic drug or meperidine. Sufficient time must elapse for the routine preoperative medication to take effect.

Prochlorperazine and perphenazine were effective ataractic drugs in doses previously described. However, they do not cause the

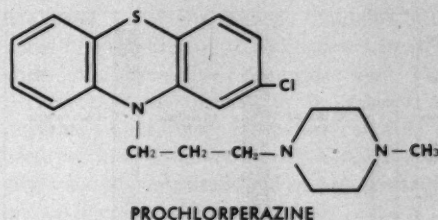


Fig. 2 (Harley and Mishler). Prochlorperazine.

somnolence so frequently noted with chlorpromazine. Patients frequently became amnesic with chlorpromazine but no amnesia was evident with prochlorperazine or perphenazine. It was our observation that chlorpromazine was a more potent ataractic than the other two phenothiazine derivatives. It was also observed that patients who were particularly apprehensive were more inclined to be nauseated postoperatively. The therapeutic effect of these drugs on the anxious patient is impressive.

Nausea and the act of vomiting can be easily recorded for statistical analysis. However, since emesis is almost invariably accompanied by nausea we assumed that all patients with emesis had nausea while the reverse was not true. Nurses and attendants were requested to be particularly attentive to the symptom of nausea so it could be recorded and charted during the day or night. In a previous report¹ the drug was given only for nausea or vomiting during the postoperative period. In the third, fourth, and fifth series of cases the ataractic agent was prescribed on a scheduled six-hour basis which eliminated any factor of chance or clinical judgment on the part of nurse attendants.

Nausea and vomiting were graded accord-

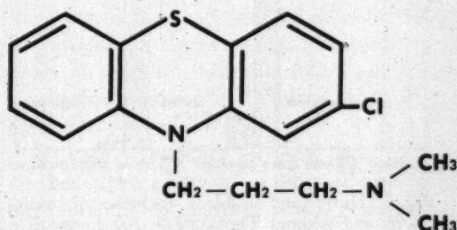


Fig. 1 (Harley and Mishler). Chlorpromazine.

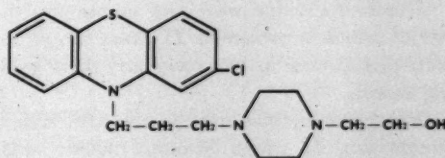


Fig. 3 (Harley and Mishler). Perphenazine.

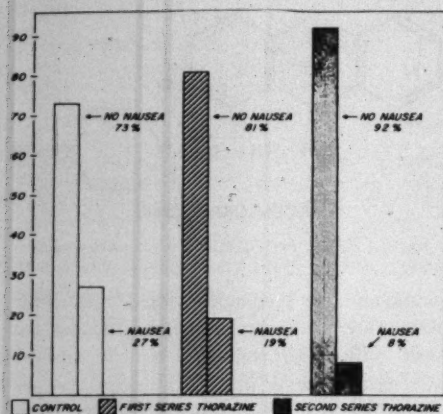


Fig. 4 (Harley and Mishler). Incidence of nausea with or without Thorazine in 300 consecutive cataract extractions.

ing to severity. If the nausea or vomiting occurred but once or twice it was scored as minimal. Nausea and vomiting which occurred three times or more were recorded as severe. It is the severe vomiting which as we know may lead to complications during the postoperative period.

Nausea was reduced from 19 cases in the second series using chlorpromazine to eight cases in the third series in which the same drug was used. Vomiting was reduced from eight in the second to two in the third series. Chlorpromazine given as an emetic prophylaxis at regular intervals appears to be a preferable method.

Statistical analysis of these results indicates that the number of cases is sufficiently large (100 cases without chlorpromazine and 100 cases with chlorpromazine) to reach or exceed the five-percent level of probability for a chi-squared test of the double dichotomy. In this instances we are comparing the first or control series with the third series.

Prochlorperazine was used in the fourth series which represented 25 cases. Minimal nausea occurred in two cases and there was no emesis.

Perphenazine was used in the fifth series comprising 25 cases. Minimal nausea was registered in four cases. There was minimal

vomiting in three cases. Two of the cases of emesis occurred preoperatively on the operating table. Within 20 minutes nausea and vomiting had disappeared without further medication and the operation was performed without additional incident. There was no vomiting during the postoperative period in either case. No severe vomiting occurred with perphenazine.

Abdominal distention has been cited as a prime cause for postoperative vomiting. This symptom has been rarely encountered in our series. We believe that having the patient sit up immediately following surgery and getting the patient out of bed the first day postoperatively have reduced this abdominal complication.

COMMENT

One may conclude that these phenothiazine derivatives exert a selective inhibitory effect on the functions of the central nervous system especially in the field of psychomotor and emotional activity. These drugs seem to be particularly useful as effective adjuvants in cataract surgery. Considerable care must be exercised when using chlorpromazine together with other narcotics and sedatives in patients beyond 65 years. Excessive somno-

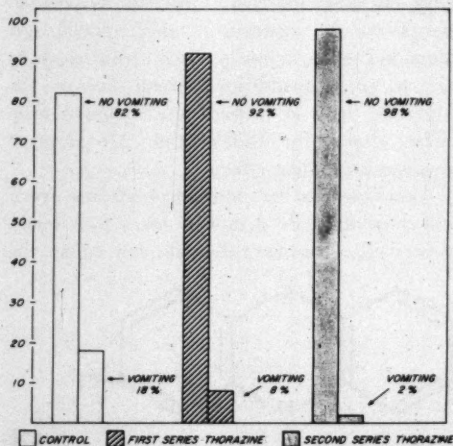


Fig. 5 (Harley and Mishler). Incidence of vomiting with and without Thorazine in 300 consecutive cataract operations.

lence may be hazardous since frequently the subject is beyond the zone of passive cooperation where movements are unpredictable. Excessive sedation did not occur with prochlorperazine or perphenazine.

Repeated observation has confirmed the opinion that nausea and vomiting occurring within the first 48 hours are frequently related to the surgery whereas when these symptoms occur after 48 hours they commonly result from medical complications.

There were four serious complications which may or may not be related to the medication. Case 34 in the third series developed an atelectasis his first postoperative night. He had been able to expectorate heavy mucus for many years and undoubtedly this was a factor in the etiology. Case 18 in the second series developed a coronary infarction the first postoperative day. Case 14 in the second series developed a pulmonary infarct. Case 22 in the fifth series had a cerebrovascular accident on the third postoperative day.

Vascular accidents in aging patients perhaps may be precipitated by the slowing of the blood stream which may occur from the hypotensive effect of these drugs. The majority of the patients ranged between 65 and 70 years of age.

The chlorpromazine pallor with its resemblance to shock may sometimes give rise to alarm. This appearance generally occurs 30 to 40 minutes after oral medication when the patient becomes calm and relaxed. Ordinarily, the blood pressure drops moderately but the patient remains warm and dry with pink nail beds. Should the hypotensive effect become more severe, elevation of the legs, lowering of the head, and the administration of vasopressor drugs may be necessary. Two cases in our third series following chlorpromazine medication required such treatment.

No case of jaundice occurred in our series. In the estimated seven million patients who have had chlorpromazine in this country the incidence of jaundice irrespective of dosage

has been low.²² In Europe jaundice was noted in only three of 10,000 patients treated with chlorpromazine (Stewart and Redecker²³). This appears to be related to duration of treatment since few cases have occurred in less than one week. Chlorpromazine may be contraindicated in patients with known liver disorders.

Agranulocytosis has been reported as a rare complication and nearly all cases have occurred between the fourth and 10th week of treatment.²⁴

Dermatologic reactions in the form of a mild urticarial eruption have been reported. They are believed to be of allergic origin and clear promptly upon withdrawal of the drug.²⁴

Extrapyramidal effects ranging from a motor restlessness to a Parkinson-like syndrome have been seen in some patients receiving perphenazine and prochlorperazine. However, these symptoms disappeared within 48 hours following withdrawal of the drug.¹⁸

We observed no serious complications in our cases on perphenazine or prochlorperazine therapy. Two cases (one outside of this series) developed a skin rash following perphenazine therapy.

When administering these drugs one must remain alert to the possible occurrence of blood disorders or other toxic manifestations which may develop with some phenothiazine compounds.

The antiemetic effect of perphenazine and prochlorperazine requires further investigation since 50 cases are not a sufficient number for definite conclusions.

SUMMARY

1. An attempt has been made to evaluate the usefulness of chlorpromazine (Thorazine®), prochlorperazine (Compazine®), and perphenazine (Trilafon®) in 250 consecutive cataract extractions. The results have been compared with an additional control series of 100 consecutive cataract extractions in which these drugs were not used.

2. All three drugs studied are chemically related as phenothiazine derivatives. Chlorpromazine was used as the primary representative of the group in 200 cases.

3. Chlorpromazine, prochlorperazine, and perphenazine were chosen for evaluation because of their reputed ability to relieve anxiety and minimize the incidence of nausea and vomiting.

4. All three drugs have an impressive therapeutic effect on the tense and apprehensive patient. Chlorpromazine was judged to be the most potent sedative as measured by relief of tension, anxiety, and apprehension.

5. Chlorpromazine exhibited pronounced antiemetic qualities when administered preoperatively and postoperatively at prescribed intervals for 48 hours. No vomiting occurred during the use of prochlorperazine in 25 cases. There was minimal vomiting with perphenazine in three cases but two cases were

preoperative and improved within 20 minutes without further medication. No severe vomiting was recorded with perphenazine in 25 cases.

6. A severe hypotensive reaction was the most disturbing side-reaction encountered. Two patients required special measures to reverse the marked hypotension and combat excessive somnolence following the preoperative medication with chlorpromazine, sedatives, and analgesics.

7. The potentiating action of chlorpromazine demands special precautions when the drug is used as part of the routine medication in older patients undergoing cataract surgery. Prochlorperazine and perphenazine have exhibited a low order of potentiation with respect to barbiturates, opiates, and similar depressant drugs.

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JOHANNES MÜLLER ON THE INVERTED IMAGE

A NEW AND UNABRIDGED TRANSLATION

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INTRODUCTORY NOTE

April 28, 1958, marked the centennial of the death of Johannes Müller (1801-1858). To commemorate the life and works of this great historical figure, we present as a tribute to his genius a new translation of one of the most significant and profound chapters in his theory of vision. It is found in his famous *Handbuch der Physiologie des Menschen*.

Müller's most famous and lasting contribution was the law of the "specific energy of the nerves" according to which a given sensation depends on the stimulation of a given sense organ rather than the mode of stimulation; the key to this law was an auto-observation, that is, the experience of phosphenes resulting from ocular pressure. This phenomenon figures in the chapter here translated. The experiential implication of this law is that various events, external to man, may cause the same sensation in him; the philosophic implication is that man does not experience the external event itself but only his sensorial response to the event.

The English translation of his *Handbuch der Physiologie des Menschen* by William Baly leaves much to be desired when compared with the original German text. Unfortunately, it is the only translation into English so far as we can ascertain. Moreover, there are serious omissions in the American edition of 1843. These may account in part for the somewhat less than prominent position Müller has held in the English-speaking scientific world.

The problems discussed in the chapter here

newly translated are those of the inverted retinal image, its relationship to erect vision, and the implied concept of projection. These are among the crucial and still unsettled problems in the theory of vision.

INVERTED VISION AND ERECT VISION*

According to the laws of optics, images are represented on the retina as inverted relative to objects; what is above in the object appears below in the image and vice versa, what is right is to the left and what is left is to the right, whereas the relative position of the parts of the picture remains just the same. The question arises whether one sees images inverted as they actually are or erect as in the object. Since images and affected retinal elements are one and the same, the question physiologically expressed is whether, in seeing, the retinal elements are sensed in their true relationship to the object.

My view of the problem is already developed in my work on the physiology of vision as follows: Though indeed we see in an inverted fashion, it is only through optical investigation that we can become aware that we see inverted. Moreover, if everything is seen inverted, the order of objects is not disturbed in any way. It is the same as with the daily inversion of objects by revolutions of the whole earth which one becomes aware of only by observing the

* Johannes Müller: *Handbuch der Physiologie des Menschen für Vorlesungen*. Coblenz, Verlag von J. Hölscher, 1840. Zweiter Band, Seite 357-359.

position of the stars; and still it is certain that within 24 hours, something is then above relative to the stars which was previously below. It is for this reason that in seeing there occurs no disharmony between inverted vision and erect touch (*geradefühlen*) precisely because everything including the parts of our body are seen inverted and everything maintains its relative position. Even the image of our touching hand is inverted. Thus we call objects erect just as we see them. We hardly realize a mere reversal of sides in the mirror where the right hand occupies the left part of the image; when adjusting our movements according to the mirror image, our sensations conflict but slightly with what we see, for example, when making a knot in a tie according to the mirror image. It is true that there remains some conflict since the reversal is incomplete, involving only the sides and because not everything is reversed.

Volkman agrees with this view. He, too, maintains that we need no explanation of erect vision as long as the eye doesn't see one single thing but everything inverted. Volkman says that nothing can be inverted when nothing is erect. Indeed the two concepts exist only in antithesis to one another.

The explanation of erect vision according to which one does not see the retinal image, but the direction of the light rays implies something impossible. Indeed there is no definite direction of light rays, but a whole light cone corresponds to each point; moreover, it is always the condition of the parts of the retina which is sensed and never something lying in front of them. Similarly, it is an entirely arbitrary assumption that the retina acts outwardly and projects objects in a crossing direction, for instance in the directions perpendicular to the retinal curvature (Bartels); it would indeed be far from intelligible to assume that one direction is preferred to another; moreover, should each part of the retina have the ability to act outwardly, it would act in as many directions

as radii* could be drawn from it toward the outer world. But since one can never realize inverted vision, it is not probable that nature has made a provision in the brain or elsewhere for the correction of an error which one can only realize by optical investigations. Nor can the crossing course of the optic nerves be made responsible since it is only a partial one. (See for this subject: Berthold, *Über das Aufrechtstehen des Gesichtsbjektivs*, Gött, 1830, and Bartels, *Beiträge zur Physiologie des Gesichtssinnes*, Berlin, 1834).

Should it be possible that the image of an object could originate on the retina without the action of light, for example through immediate contact, an appearance of the object without reversal of the image would result. Should it be possible to see the same object at one moment by means of external light and at another time by means of striking the retina immediately, the images produced in both ways would lie on opposite sides. This indeed is experimentally possible. If, for example, one presses his finger on the retina through the sclera, one obtains an immediate pressure image ("Druckbild").† At the same time one can see the finger by means of external light. The two images lie on opposite sides. If in the dark, and with his eyes closed, one presses his finger which is seen above on the upper part of the eye, the pressure image appears below; if one presses on the lower part of the retina, the pressure image appears above, if one presses on the right side of the retina, the pressure image appears on the left and vice versa.

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* Müller obviously meant that light is reflected back from the retina in all directions just as it is from each point source of light. Since, according to Müller, it is only the retina which can be sensed and not what lies in front of it, for example these reflected rays, there is no means for determining which single ray represents the line of direction from which the light originally came. Therefore, the retina cannot "know" where to project each particular point, not to mention the whole image.

† Now known as pressure phosphene.

BULBAR COMPRESSORS*

BILATERAL BULBAR COMPRESSION IN THE DIAGNOSIS AND MANAGEMENT OF GLAUCOMA

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It is fully realized that tonometry alone will not rule out glaucoma in the early stages, also that when field changes are detected, it is usually in a late stage of chronic simple glaucoma. Therefore, it is hoped that bilateral bulbar compression will receive careful study because of its possible use in the diagnosis of early glaucoma, as well as in its management. As a background for consideration of bulbar compression, a brief review of routine tonometry and some of its limitations should be helpful.

Routine tonometry has been stressed for general practitioners¹ and this idea is apparently justified because of the 1.5 to 2.0 percent of patients over 40 years of age who have been found to have glaucoma.^{2,3} In response to a questionnaire in 1955, 118 ophthalmologists co-operating in a glaucoma survey reported that a total of 1,114 cases of suspected glaucoma were detected by general practitioners who were using the Hypertension Indicator in routine examination of their patients.

When tonometry alone is used for glaucoma case finding, it may be expected to show a lower incidence of glaucoma than the true number because ocular hypertension is commonly intermittent in chronic simple glaucoma. The patient may present himself for examination when his tension chanced to be normal. For this reason it is important to reduce the number of false negative diagnoses when screening for glaucoma through tonometry alone. The new design of a bulbar compressor and some new developments as-

sociated with its use in bilateral simultaneous bulbar compression tests are presented.

TONOGRAPHY AND BULBAR COMPRESSION

Most workers in tonography agree that this is and should be a laboratory test in skilled hands.⁴ That bulbar compression causes lowering of ocular tension has been realized since Pagenstecher⁵ first called attention to this in 1878. The work of Schiøtz in 1908⁶ led one of us (C. B.) to construct lead weights to be applied to the eye through the eyelids, during World War I. Also, there may have to be some revision of present concepts of tonography because among other possibilities for error, applying pressure to one eye affects the tension in the other eye.^{7,8} Scheie, Spencer, and Helmick⁹ have pointed out the limits of the clinical application of tonography. Therefore, we advocate routine bilateral simultaneous compression of the eyes and repeating tonometry as a daily procedure in office practice¹⁰ not only in attempting to detect glaucoma early, but also in the study and management of glaucoma.

For several years we have used for bulbar compression, the Bailliart instrument (ophthalmodynamometer) designed for studying retinal blood pressure.¹¹

Because the instruments are long and the scales difficult to read when applied to both eyes simultaneously and because the rounded ends applied to the globe often slipped, it was considered desirable to construct a new instrument and use a pair for bulbar compression.

Our experience had shown that an external pressure of 50 gm. could suitably be employed to effect the desired result and be within limits comfortable to the patient. We received encouragement for this plan from Goldmann. The pressure, 50 gm., is applied

* From the Department of Research, New York Association for the Blind and the Department of Ophthalmology, New York University Post-Graduate School of Medicine. This research was aided by a grant from The Ophthalmological Foundation, Inc. The bulbar compressors are made by Matalene Surgical Instrument Co., New York.

to both eyes simultaneously because, if pressure is applied to only one eye, the tension of the eye to which pressure is not applied, may be affected. The new instrument has therefore been designed to exert a pressure of 50 gm. and is so indicated on a clearly visible scale.

This method of studying the effect of bilateral compression of the eyes has been referred to previously.¹⁰ The findings by Duke-Elder, using a Schiøtz tonometer during the test and a Bailliant dynamometer at 50 gm. in a series of 83 normal eyes, showed almost 100 percent negative. In 20 patients with glaucoma in one eye, and no symptoms in the other eye, the test was positive in 85 percent in the "nonglaucomatous" eyes. In 27 patients who had no symptoms of glaucoma but some provocative tests were positive, the bulbar compression test showed positive findings in 86 percent of these eyes.

Blaxter¹² tested each eye individually, applying a Schiøtz X tonometer to the cornea and the simultaneous application of a Bailliant dynamometer to the sclera for a period of four minutes. He reported that the results obtained, when the Schiøtz tonometer was used alone, showed a much smaller percentage of positive results than were obtained with the bulbar compression test. He concluded that this is probably due to the fact that the compression (13 gm.) is below the optimum compression of a normal eye and is therefore insufficient to accentuate differences in the facility of outflow unless the obstruction is marked. While a negative result is therefore of no significance, a positive result undoubtedly indicates a severe degree of obstruction.

In measuring the facility of aqueous outflow Foulds¹³ reported that in the suspected glaucoma group the fall in outflow indicated by his test was 50 percent. This test was also used to determine the efficacy of treatment with miotics. Hotta¹⁴ claims that during compression of the eyeball with a constant pressure, no obvious drop of ocular tension is demonstrable by manometry. After the ces-

sation of the compression, the ocular tension appears considerably lower than the original tension by tonometry but it is not so low when measured by manometry. He considers that an eyeball compression test mainly causes a change in the rigidity of the ocular coat.

Recently Hodgson and Macdonald¹⁵ combined both corneal and scleral compression, using the Mueller electronic tonometer in a method which is easily standardized and causes a minimum of discomfort to the patient, and which they believe yields valuable information, particularly with regard to borderline cases. They conclude that this method, called corneoscleral tonography, using the electronic tonometer, is a practical and fairly accurate test in the diagnosis of glaucoma. Cases of closed-angle glaucoma, even in interval stages, fall within the glaucomatous group, and cases of moderate to severe loss of visual field, even in true low-pressure glaucoma, fall within the glaucomatous group.

SPECIFICATIONS OF THE BULBAR COMPRESSOR

The bulbar compressor, made of stainless steel, is 10 cm. long and 7.0 mm. in diameter (fig. 1). Precision springs of copper berilium are used in compression. The "footplate" is concave. Near this concave end, at approxi-

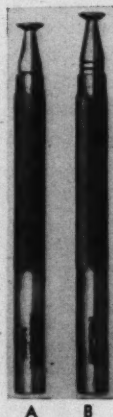


Fig. 1 (Berens and Tolman). Bulbar compressor. (A) Exerting pressure. (B) Note two lines on the shaft of bulbar compressor which are bisected when 50 gm. of pressure is applied to the eyeball.

for two minutes. Tension is then taken with the Schiøtz tonometer and all the findings are noted in the spaces stamped on the record (fig. 4). The tension may be taken several times during the test and at varying intervals later but for routine office practice it is usually sufficient to take the tension before and after the application of the compressors.

It has been found desirable to record these data each time tension is taken as there is considerable variation at different examinations even when done at the same time of day and with the same time interval following the use of the same strength of miotic. For this reason the patient's mental and physical conditions are noted in the proper place in the stamped record (fig. 4) and any systemic medication is recorded, especially the use of sedatives, Diamox, and antihistamines.

SUMMARY AND CONCLUSION

A bulbar compressor is described and two

of these instruments are applied to both eyes, simultaneously exerting pressure of 50 gm. for two minutes. By comparing the tension before and after the application of the compressors, some knowledge is gained of the behavior of the intraocular pressure following compression of the eyeballs.

The findings which will be published later have given valuable information which, in our opinion, has aided in the early diagnosis of glaucoma in some cases. Evaluation of the results of the test has been helpful in the pre- and postoperative examinations, as well as in routine tonometry study of patients.

It is recommended that these bilateral compression findings be taken and recorded at each examination, as well as data concerning the mental and physical condition of the patient, and the use of ocular and systemic medication, especially Diamox, sedatives, and antihistamines.

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IN-VIVO STORAGE OF CORNEAL GRAFTS*

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Although most keratoplasty surgeons still consider it necessary to use fresh corneal tissues for full-thickness grafts, there is increasing evidence that lamellar grafts may be performed successfully with preserved tissues.

Storage, in addition to holding tissues in reserve for future surgery, appears to have the advantage of reducing antigenicity in corneal grafts. Two methods currently under investigation, namely, storage at 4°C. up to two weeks and deep freezing at -79°C. after pretreatment with glycerine, have resulted in viable tissues which gave fewer graft reactions in animal experiments than did fresh tissues (unpublished data).

The present study was undertaken to determine the effect of in-vivo storage in the interlamellar space of rabbit's cornea, upon the morphology, antigenicity, viability, and transplantability of homo- and heterogenous corneal tissues. Having previously reported experiments in which the interlamellar technique was used for the study of immunologic reactions in homo- and heterogenous corneal grafts¹⁻³ we wished to determine if the antigenicity of the corneal donor tissues might be modified by interlamellar storage.

METHODS AND MATERIALS

Fresh donor materials were obtained from rabbit, beef, and human cadaver corneas. Lamellar discs, five mm. in diameter and 0.3 mm. in thickness, were cut from the anterior surface of the donor corneas, some with and some without the epithelium. These discs were grafted interlamellarily into the corneas of a group of rabbits (referred to as the first group of carriers) and stored for

periods up to 24 weeks. Only those grafts which remained clear after interlamellar storage were chosen for regrafting.

Interlamellar grafts which remained clear in the first group of carriers were dissected out at different intervals. Twenty of these grafts were used for morphologic studies. Seventeen were used for the study of viability in tissue cultures. Eleven were regrafted interlamellarily, after a minimum period of in-vivo storage of five weeks, into the eyes of a second group of rabbits, and subsequently the same tissues were taken out after a period of four weeks, and regrafted onto a third group of rabbits. The remaining tissues, consisting of 10 each of rabbit, beef, and human interlamellar corneal grafts, were transplanted by the lamellar method into the eyes of a fourth group of rabbits, and were observed for more than three months.

RESULTS AND OBSERVATIONS

The interlamellar position and the composition of the intracorneal fluid seemed favorable for storage of corneal tissues. Both the insertion within the cornea of the animals and the subsequent removal of the grafts from the interlamellar pouch were easily carried out.

1. INTERLAMELLAR GRAFTS

In the first group of carriers. The fate of the interlamellar homo- and heterografts in the first group of carriers has been summarized in Table 1.

Interlamellar grafts with epithelium resulted in almost double the number of clear transplants with homografts than with heterografts. When the epithelium was removed from the donor tissues prior to grafting, the number of clear grafts with homo- and heterogenous tissues became almost the same.

Morphologically, the interlamellarily pre-

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TABLE 1
THE FATE OF INTERLAMELLAR CORNEAL HOMO- AND HETEROGRAFTS IN THE FIRST GROUP OF RABBITS
(percentage)

Interlamellar Grafts	Homografts		Heterografts	
	With Epithelium	Without Epithelium	With Epithelium	Without Epithelium
Clear from beginning	60	80	10	70
Immunologic reaction				
(i) Temporary opacity	20	10	37	10
(ii) Permanent opacity	10	5	43	15
Opaque from beginning	10	5	10	5

served grafts retained normal consistency and transparency and were suitable for re-grafting. The original size and thickness remained unaltered. The grafts could be removed easily from the carriers' interlamellar pouches since there was little adhesion between the graft and the surrounding host tissue up to a period of three months.

Histologically, the interlamellarly preserved tissues were similar to normal fresh tissues and there was no sign of active invasion of the grafts by the carrier tissues. In general, the epithelium of the interlamellar grafts could not be demonstrated after a period of four weeks of storage and the graft thenceforth consisted only of stromal tissue.

In tissue culture, all the grafts, both homo- and heterogenous, were viable.

2. REGRAFTING

a. *Interlamellar grafting in second and third groups of rabbits.* Eleven interlamel-

larly stored homo- and heterografts were re-grafted by interlamellar technique into the corneas of the second and third groups of rabbits successively (table 2). Some of these tissues had shown temporary opacities due to immunologic reactions in the first group of carriers but none showed any reaction in the second and third groups of rabbits (fig. 1). Morphologically and histologically, grafts removed from the third group of rabbits were similar to those from the first group.

In Table 2 it will be seen that with interlamellar heterografts, the immunologic reactions in the first group of rabbits occurred only when the epithelium was present. The same tissues, when re-grafted, did not give rise to any further reactions in the second and third groups of animals. When the interlamellar graft consisted only of stromal tissue, there was no reaction in any of the groups of rabbits.

b. *Lamellar grafting in the fourth group of rabbits.* Thirty clear interlamellar homo-

TABLE 2
INCIDENCE OF IMMUNOLOGIC REACTIONS WITH INTERLAMELLAR CORNEAL GRAFTS
IN DIFFERENT GROUPS OF RABBITS

Donor Tissues	No. of Grafts		No. of Grafts Developing Reaction		
	With Epithelium	Without Epithelium	1st Group	2nd Group	3rd Group
Rabbit	2		2	0	0
Rabbit		2	0	0	0
Beef	2		2	0	0
Beef		2	0	0	0
Human	1		1	0	0
Human		2	0	0	0

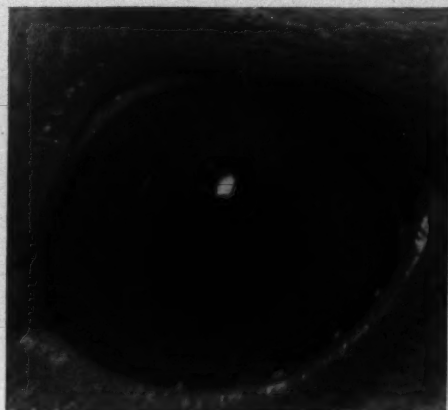


Fig. 1 (Basu and Ormsby). Clear interlamellar heterograft (human) in third group of rabbits.



Fig. 2 (Basu and Ormsby). Clear lamellar heterograft (beef) following in vivo storage for 10 weeks.

and heterografts, 10 from rabbits and 10 each from beef and human, stored in the first group of carriers for periods of from five to 11 weeks, were regrafted as lamellar grafts into the fourth batch of rabbits. Since the interlamellar grafts had retained normal consistency, size, and thickness, there was no technical difficulty in regrafting them as lamellar transplants. From parallel histologic studies, it was assumed that these grafts stored interlamellarly for five weeks or more did not possess any epithelium. Six out of 10 homografts and 10 out of 20 heterografts remained clear during an observation period of more than three months (table 3). When failures occurred, it was usually due to defective fixation. The absence of the epithelium in the donor material did not give rise to any complication during the postoperative period, and the grafts were uniformly covered by the host epithelium.

It will be seen that 60 percent of rabbit

and 50 percent of beef and human interlamellarly stored grafts remained clear after lamellar grafting (figs. 2, 3, and 4).

DISCUSSION

The reduction in antigenicity in the interlamellarly stored grafts suggests that a change in the corneal proteins occurred during storage. There are at least two possible means by which this might have taken place; either the corneal antigens are associated with the soluble protein fraction and are dissolved out during storage or they are associated with the epithelium, which is lost during storage and is not present in the graft upon retransplantation.

In these experiments, the reduction in the percentage of reactions in stored corneas

TABLE 3
INCIDENCE OF SUCCESSFUL LAMELLAR GRAFTS WITH INTERLAMELLARLY STORED
HOMO- AND HETEROGRAFTS

Donor Tissue	Period of Storage (wk.)	No. of Lamellar Grafts	No. of Clear Grafts
Rabbit	5 to 8	10	6
Beef	5 to 10	10	5
Human	5 to 11	10	5



Fig. 3 (Basu and Ormsby). Clear lamellar heterograft (human) following in vivo storage for 11 weeks.

when the epithelium is removed before storage (table 1) suggests that the absence of epithelium in the in-vivo stored grafts accounts for the major reduction in the immunologic reaction upon regrafting.

As there was very little gross and histologic evidence of adhesion between the grafts and the carrier tissues, it was difficult to tell whether the grafted tissues were replaced by the cells of the first group of carriers (in which case a heterograft after interlamellar storage would become a homograft immunologically).

The possible clinical applications of in-vivo storage are intriguing. From these studies it would appear that donor corneas from human or animal sources could be stored interlamellarly in an experimental animal, thus solving the problems of the preservation of the tissue and at the same time reducing the antigenicity.

SUMMARY

1. Lamellar pieces of homo- and heterogenous corneal tissues, with and without epithelium, were grafted interlamellarly into rabbits' corneas and stored for varying periods. Following removal from storage, studies were made of their morphology, histology, and viability in tissue cultures. Some of these interlamellarly stored tissues were regrafted by interlamellar and lamellar techniques onto the eyes of different batches of rabbits.

2. The interlamellarly stored tissues were similar to fresh tissues both morphologically and histologically. The epithelium did not survive for more than four or five weeks in interlamellar storage. In tissue culture, all of the interlamellarly stored tissues were viable.

3. Both homo- and heterogenous grafts which had been stored interlamellarly re-

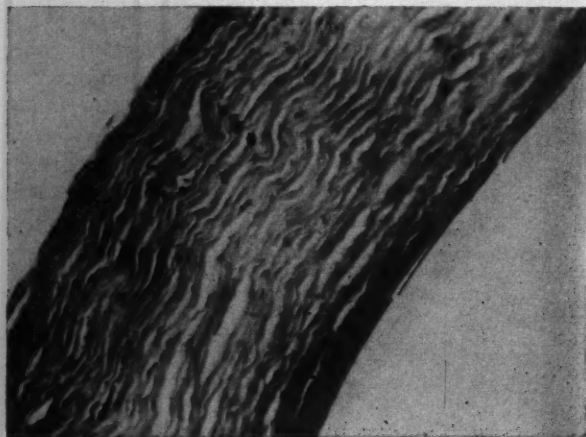


Fig. 4 (Basu and Ormsby). Clear lamellar heterograft (human) following in vivo storage for 11 weeks.

mained transparent indefinitely on successive interlamellar and lamellar regrafting.

4. It appeared that heterografts lost most

of their antigenicity on interlamellar storage.

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ADENOCARCINOMA METASTATIC TO THE DISTAL NERVE AND OPTIC DISC*

A STEREOGRAPHIC CLINICOPATHOLOGIC ANALYSIS

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Study of the literature indicates that adenocarcinoma metastatic to the disc end of the optic nerve, the sole concern of this paper, is not commonly encountered. Two contributions, one made by Davis¹ in 1932 and the other by McDannald and Payne² in 1934, appear to be germane. The diagnosis in the first case was made exclusively from clinical information. In commenting on the case, Suker expresses opinions having somewhat different connotations. Early in his discussion, he states that there is little room for doubt that the correct diagnosis is metastatic carcinoma to the optic disc. Somewhat further along he mentions that Davis' case is a metastasis from the choroid into the disc and then along the nerve. Unfortunately pathologic confirmation was not obtained. The authors of the second paper considered it debatable as to whether the metastasis was primary in the optic nerve with secondary choroidal involvement or whether the reverse mechanism was actually the situation. In commenting on this case, Reese felt that the former view unquestionably represented the correct mechanism.

CASE HISTORY

Past history. The patient, an intelligent and

highly co-operative 31-year-old white woman with known generalized metastasis, was admitted to the hospital for the fifth time following a mastectomy of the right breast performed five years previously. Questioning revealed that during this period there had been two recurrences in the mastectomy scar, as well as the development of an enlarged tender lymph node in the right axilla which was proven to be carcinoma through pathologic study. Further interrogation indicated no familial history of cancer. The chief ocular complaint at the time of the present admission was a gradual decrease in the vision of the left eye during the past five months. The patient stated that the vision of her left eye had always been considerably better than that of her right eye. Records of previous hospitalizations revealed a long-standing amblyopia present in the right eye and 20/20 vision in the left eye. Both ocular fundi were recorded as normal, and the left optic disc was described as having a large physiologic pit. The past history also revealed that peripheral fields were essentially normal and that a neurologic examination, performed about two and a half months prior to the present admission, revealed no abnormal neurologic signs.

Ocular examinations. Beginning with the fifth hospitalization, I carried out a series of ophthalmic examinations performed at periodic intervals during the last five and a half months of life. During this period the patient was in and out of the hospital. Pupillary response to light and convergence was present but was obviously sluggish.

Visual field studies were performed on several occasions but gave a transient picture in that they were found to fluctuate, a defective zone in one examination appearing to be a functional area at the time of the next field test. Because of this state of flux, little significance was attached to these studies.

The patient did not appear to have nor did she complain of ocular pain or headaches. Intraocular pressure determinations were within normal limits.

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Ocular motility was demonstrated to be normal. During the series of ophthalmic examinations, the visual acuity of the left eye was recorded as 20/100, counting fingers at two feet, 20/80, and 20/50 with "come and go" vision.

At all examinations the patient was lucid and exhibited a remarkable degree of co-operation and ability to concentrate during such intricate procedures as field studies and retinal stereophotography in spite of her obviously debilitated and fatigued condition. The patient died approximately six months after I first began ocular examinations.

CORRELATED CLINICOPATHOLOGIC ANALYSIS

In this case the clinical pathology manifested itself primarily as an elevation of the optic disc of the left eye. This point of maximum pathology was documented by making a serial stereophotographic study of the left fundus over a period of several months. The photographs shown in Figures 1 and 2 are representative fundus stereograms taken from this series. These tridimensional pictures may be view directly from the page by using a mirror method described by Norton³ in 1955.

One or two features of these photographic records deserve comment. In the first stereogram, the upper portion of the disc shows definite elevation while the lower portion shows very little deviation from the surrounding retinal plane. The second stereogram, taken about two and a half months after the first reveals that the entire disc had

undergone considerable elevation, the superior disc showing an abrupt fall-off from the summit of the elevation while the inferior half of the disc reveals a gradual descent to the retina. Ophthalmoscopically and/or stereophotographically speaking, no distinction could or can be made between the type of tissue composing the upper half of the disc from that making up the lower portion of the disc.

The two retinal stereograms were taken during the last three and a half months of life, the second having been taken just two weeks prior to death. Because the stereoscopic views, when fused, reveal all important features as they existed in life, a lengthy description of each fundus photograph seems noncontributory.

At this point, it is well to correlate the retinal stereograms with Figure 3. The photomicrograph confirms the above-mentioned clinical observations of the left optic disc, abrupt descent from the disc to the superior retina, and gradual descent to the inferior retina. In addition, it can be clearly seen that roughly the upper half of the disc is composed of tumor tissue while the lower half is composed of edema tissue, a distinction that could not be made clinically. The tumor tissue is seen to stain considerably denser than the other tissue. The microscopic sec-

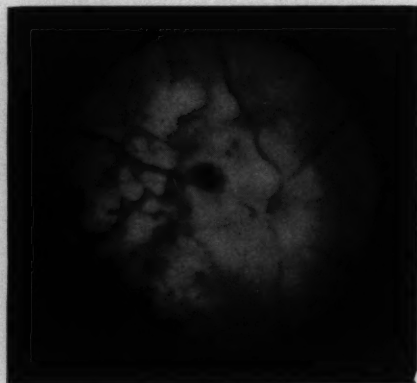
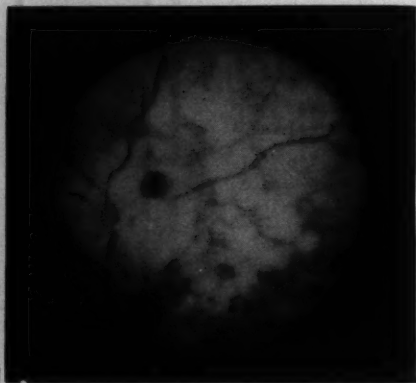


Fig. 1 (Norton). Retinal stereogram, showing early elevation of the upper portion of the left optic disc. The superior vessel is seen to pass over the elevation. (See text for viewing method.)

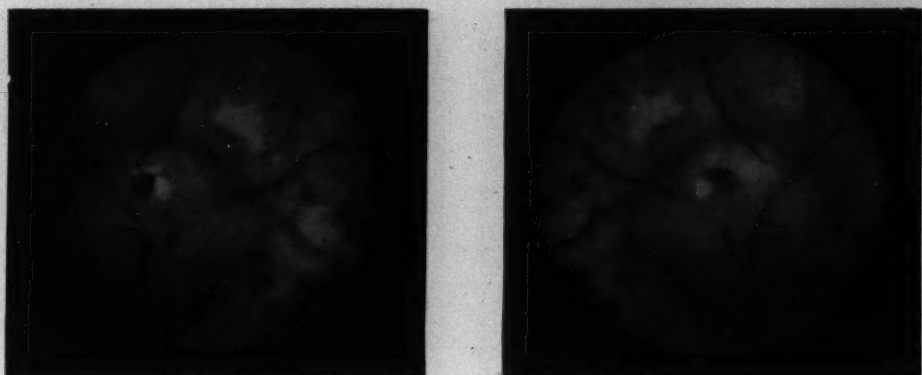


Fig. 2 (Norton). Retinal stereogram, showing extensive disc elevation. This stereogram was taken two months after the first (fig. 1) and two weeks before death. All vessels have been raised from the retinal plane at the base of the mass. (See text for viewing method.)

tion shows the tumor to be an isolated, circumscribed mass localized and confined to the distal optic nerve and including the disc. This paragraph has been devoted to presenting clinical and microscopic evidence that the optic disc of the left eye was elevated and that the elevation was due to a tumor of the disc.

A restudy of Figures 1, 2, and 3 will establish that the retina immediately adjacent to the disc is flat and that evidence of retinal

separation is absent. The section also reveals that the peripheral retina, except for an artefact occurring during fixation, is attached throughout. In the event that the optic disc had become involved secondarily by direct spread from a choroidal tumor, by far the more common mechanism, then retinal elevation-separation would be expected.

A higher-power evaluation of the disc, border tissue, and scleral canal areas may be made from Figures 4 and 5. Figure 4 shows the upper portion of the disc while the lower portion is depicted in Figure 5. Both views show the retina to be compressed and pushed away from its usual location near the disc border. The retina does not appear to be invaded. The border tissue is intact and the choroid is free from tumor. The intravaginal sinuses, just seen in these views, are normal in appearance.

A second compression phenomenon can be seen in Figure 3 wherein the tumor is seen to encroach upon and narrow the superior sinus. The aim of this section has been to offer evidence which reasonably rules out that the optic disc might have become involved secondarily by a direct spread mechanism from the adjacent choroid.

The gross outward appearance of the optic nerve and globe was normal. The nerve showed no increase in diameter as might be

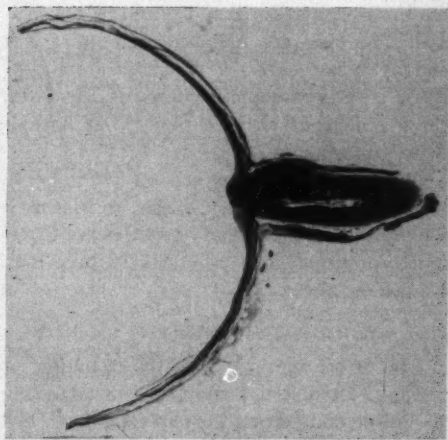


Fig. 3. (Norton). Low-power photomicrograph, showing isolated tumor mass confined to the distal end of the left optic nerve and disc.



Fig. 4 (Norton). High-power section, showing upper portion of the left optic disc elevation to be composed of tumor tissue metastatic from the right breast. The border tissue is intact, the choroid normal, the retina compressed.



Fig. 5 (Norton). High-power section, showing the lower portion of the left optic disc elevation to be composed of an edematous type of tissue. Tumor tissue is absent.

expected if the nerve sheaths were involved by tumor infiltration. The sheaths can be seen to be normal in appearance in Figure 3. The sinuses are essentially clear and normal with the exception of the narrowing already considered above. There was no clinical evidence which might suggest nerve sheath involvement. Higher power views of the dura, pia, and arachnoid, not included here, indicated that these tissues were normal in appearance.

The last portion of this analysis will be concerned with excluding the possibility that the distal nerve may have become involved by tumor formation through an extension down the nerve from an intracranial metastatic source. The lack of headaches and abnormal neurologic signs, and the ability to co-operate effectively during various ophthalmologic procedures requiring a high level of concentration, were interpreted as clinical evidence that intracranial involvement had not occurred. An excerpt from the autopsy

report pertaining to the cranial cavity and its content follows:

"The scalp, skull, meninges, and vessels show no abnormality. The brain weighs 1,450 gm. The external and cut surface of the brain, spinal cord, and pituitary are normal. The eyes are removed, and the sclera and optic nerves show no gross abnormality. . . . Microscopic sections of the brain show numerous fibrin thrombi, but no evidence of tumor."

At enucleation a long section of the nerve was obtained. This is shown in Figure 3 where it can be seen that normal nerve tissue exists proximal to a point about three mm. behind the globe.

SUMMARY

The direct application of the technique of retinal stereophotography as an analyzing tool in demonstrating the clinical growth and development of a tumor of the optic disc is demonstrated. It is suggested and then emphasized that when tridimensionality is ob-

viously the more important outstanding characteristic of the point of maximum pathology, that accurate documentation depends upon the "complete" photograph or the ocular stereogram.

Photomicrographs of the optic nerve, representative of a series made in this case, are offered as pathologic confirmation of the clinical

observations. Stress is given to a correlative approach between clinical and pathologic evidence in developing an integrated analysis.
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ACKNOWLEDGMENT

I wish to express my appreciation to Prof. Lowell J. Orbison, Department of Pathology, for reviewing the pathology in this case.

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CLINICAL COMPARISON OF DICHLORPHENAMIDE, CHLOROTHIAZIDE AND SULOCARBILATE WITH ACETAZOLAMIDE IN CONTROL OF GLAUCOMA*

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Several new drugs known to act as carbonic anhydrase inhibitors have recently been introduced for clinical investigation, or placed on the market. The ocular hypotensive effect of three such drugs has been investigated in the present study: Dichlorphenamide (Daranide[†]), chlorothiazide (Diuril[‡]), and sullocarbilate (W-1548[§]). The purpose of this paper is to report on the pressure-lowering effect of these drugs in normal and glaucomatous eyes, and to compare, to some extent, their effectiveness with that of Diamox.

Dichlorphenamide appeared to have the best prospects, since in-vivo studies by the

manufacturer revealed that it is an extremely potent inhibitor of carbonic anhydrase. The sulfamyl group is essential for the inhibition of carbonic anhydrase activity and this drug has two such groups.³

Animal studies by the manufacturer showed that dichlorphenamide is at least as active as Diamox as a diuretic agent with a considerably greater duration of action. The drug was found to be rapidly absorbed in dogs following oral administration with attainment of maximal effect within 20 to 40 minutes.³

The second drug under investigation, chlorothiazide,⁴ also has a sulfamyl group and in the test tube showed some carbonic anhydrase inhibition. So far this has not been found to occur to any extent in humans.⁵

Sullocarbilate, the third drug studied, is a p-sulfamyl-2-hydroxy-ethyl-carbanilate which has a diuretic effect, both in animals and humans, following oral administration. It acts through the inhibition of carbonic anhydrase in the renal tubules.⁶ Clinically, it has been reported that sullocarbilate has more effect

*From the Glaucoma Consultation Service, Massachusetts Eye and Ear Infirmary. A portion of this paper was presented before the New England Ophthalmological Society, February 19, 1958, Boston. This investigation was supported by the Alfred P. Sloan Foundation and by research grant B-218 of the National Institute of Neurological Diseases and Blindness of the National Institutes of Health, U.S. Public Health Service.

[†] Dichlorphenamide and chlorothiazide[‡] were provided by Merck, Sharp and Dohme Research Laboratory, Division of Merck & Co., Inc., West Point, Pennsylvania.

[§] Sullocarbilate was provided by Warner-Chilcott Laboratory, Morris Plains, New Jersey.

and less side reaction or toxicity than carbonic anhydrase inhibitors currently in use as diuretic agents.⁷

PROCEDURE

A. DICHLORPHENAMIDE

Seventeen patients were used in this study. These cases were divided into three groups. The first group consisted of three normal subjects who took one dose of 100 mg. dichlorphenamide orally and were followed by tension measurements and tonography for 24 hours. The second group was composed of seven patients with open-angle glaucoma who used only dichlorphenamide to control their ocular tension. The third group also consisted of seven with open-angle glaucoma but these patients were taking various combinations of miotics for their glaucoma without satisfactory control. Dichlorphenamide was added to their schedule to evaluate the effect of this drug when used with miotic drugs.

Tension measurements and tonography were performed before giving dichlorphenamide to the patients. A trial dose of 100 mg. dichlorphenamide was given orally to each subject, following which the ocular tensions were measured at 0.5, 1.0, and 2.0 hours. Tonography was repeated at the two-hour interval to evaluate any change in the rate of aqueous formation and facility of outflow. The glaucoma patients were then placed on varying doses of dichlorphenamide, from 100 mg. to 300 mg. daily, usually starting with 100 mg. three times daily and reducing the medication as the ocular tension became normalized.

B. CHLOROTHIAZIDE

Three patients with open-angle glaucoma were selected who had shown a good response to Diamox. These patients were given 500 mg. chlorothiazide orally every 12 hours for three days. Then if there had been no effect on ocular tension the medication was increased to 500 mg. every eight hours.

C. SULOCARBILATE

Seven patients with open-angle glaucoma were selected for this study. Four of these seven patients had received no treatment previously, while the remaining three patients had shown a failure to respond to Diamox. The untreated patients were given 1.0 gm. of sulocarbilate orally every 12 hours for three days. Then if there had been no effect on ocular tension the medication was increased to 1.0 gm. every eight hours. The three patients who were not controlled by Diamox were given 1.0 gm. of sulocarbilate orally every eight hours for three days.

All measurements of ocular tension in this investigation were made with the electronic Schiötz tonometer and expressed according to the 1955 Calibration of the Committee on Standardization of Tonometers; in calculation of aqueous flow (F) the pressure in recipient veins was considered to be 10 mm. Hg.

RESULTS

A. DICHLORPHENAMIDE (DARANIDE)

Table 1 illustrates the effect of 100 mg. of dichlorphenamide on the ocular tension of the three normal subjects. Aqueous formation (F) was decreased while the fa-

TABLE 1
THE EFFECT OF 100 MG. DICHLORPHENAMIDE ON THE OCULAR TENSION
OF THREE NORMAL SUBJECTS

	Average Intraocular Pressure (mm.Hg)	Average C (cu.mm./min.)	Average F (cu.mm./min.)
Before therapy	16.6	0.27	1.41
1 hr.	14.6		
2 hr.	12.8	0.27	0.70
24 hr.	15.2	0.29	1.32

TABLE 2
THE EFFECT OF DICHLORPHENAMIDE ON THE OCULAR TENSION IN SEVEN PATIENTS
WITH OPEN-ANGLE GLAUCOMA

	Average Intraocular Pressure (mm.Hg)	Average C (cu.mm./min.)	Average F (cu.mm./min.)
Before therapy	29.0	0.14	1.65
1 hr.	25.5		
2 hr.	22.4	0.17	1.41
24 hr.	21.4	0.16	1.01
1 wk.	18.1	0.12	0.66

cility of outflow (C) remained constant. No side effects were noted by this group.

Table 2 shows the ocular effect in seven patients with open-angle glaucoma who were treated with dichlorphenamide. In all seven cases the ocular tension was reduced to 22 mm. Hg or less while taking the dichlorphenamide. The facility of outflow remained relatively unchanged while there was a significant reduction in the rate of aqueous formation.

The group of seven patients with open-angle glaucoma summarized in Table 3 had not shown a satisfactory response to various combinations of miotic drops. They all showed improvement in their ocular tension when dichlorphenamide was added to their therapy. Only two eyes in this group failed to have the tension drop to normal levels of 22 mm. Hg or less. Diamox was substituted for dichlorphenamide in these cases but the ocular tension was not any better controlled.

In 11 cases a comparison was made as to the dose of dichlorphenamide necessary to reduce the ocular tension to the same level as that produced by Diamox. In general, approximately one-third the dose of dichlor-

phenamide was needed to produce the same effect as Diamox.

The duration of effect of dichlorphenamide on ocular tension was not investigated thoroughly but it was noted that several patients with glaucoma were still well controlled 12 to 16 hours after taking the last dose of dichlorphenamide.

Side effects that the patients in these two groups noticed while taking dichlorphenamide were similar to those of Diamox. Tingling of the fingers and toes were noticed most often. Dizziness, loss of appetite, and general malaise were also reported.

B. CHLOROTHIAZIDE (DIURIL)

It was found that chlorothiazide had no definite influence on intraocular pressure or rate of aqueous formation in the three patients with open-angle glaucoma. The side-effects were similar to those produced by Diamox.

C. SULOCARBILATE (W-1548)

Two of the four untreated open-angle glaucoma patients showed a good response to sulocarbilate with a drop of their ocular

TABLE 3
THE EFFECT OF MIOTIC DROPS PLUS DICHLORPHENAMIDE ON THE OCULAR TENSION
IN SEVEN PATIENTS WITH OPEN-ANGLE GLAUCOMA

	Average Intraocular Pressure (mm.Hg)	Average C (cu.mm./min.)	Average F (cu.mm./min.)
Miotic drops alone	29.5	0.12	2.64
Dichlorphenamide added			
2 hr.	22.4	0.10	1.04
24 hr.	21.7	0.13	1.20
1 wk.	21.7	0.13	1.41

tension to normal levels of 22 mm. Hg or less. The other two patients did not respond satisfactorily. All of these four patients had shown a good response to Diamox.

None of the three patients who had failed to respond satisfactorily to Diamox gave a satisfactory response to sulocarbilate at the dosage tested.

The effect of sulocarbilate on intraocular pressure was noted within two hours after oral administration, but even when three to six times more medication were administered it had less effect on ocular tension than did Diamox. Under these conditions the side effects were also less than those of Diamox.

CONCLUSIONS

Dichlorphenamide lowers the intraocular pressure of both normal and glaucomatous eyes, presumably by carbonic anhydrase inhibition, in a manner similar to Diamox.

When dichlorphenamide is given orally it has a rapid onset of action, usually within 20 to 40 minutes. It appears to have a longer duration of effect on ocular tension than does Diamox.

When 100 mg. of dichlorphenamide is given every eight hours (300 mg./day), about the same pressure-lowering effect is achieved as by 250 mg. of Diamox given every six hours (1.0 gm./day). A daily dosage of 300 mg. of dichlorphenamide produces side effects (paresthesias, and so forth) of about the same magnitude as 1.0 gm./day of Diamox.

Dichlorphenamide appears to be as effective as Diamox in lowering ocular tension, but the side effects prevent it from being a superior drug to Diamox except in cases where the patient cannot tolerate Diamox. In these cases it should be worth while to try dichlorphenamide.

Chlorothiazide (Diuril) does not appear to have any effect on either the ocular tension or the rate of aqueous formation when given orally.

Sulocarbilate does lower intraocular pressure in glaucomatous eyes, but in a dosage three to six times to that of Diamox it had less effect than the latter drug. Higher dosages were considered to be impractical and were not investigated.

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ACID MUCOPOLYSACCHARIDES IN BEEF RETINA*

I. ISOLATION AND FRACTIONATION

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Periodic acid-Schiff positive substances located in retina and assumed to be mucopolysaccharides have been observed (in review by Dische^{1†}). No further information on the chemical composition is available. Preliminary to the exploration of these compounds in retinal pathology, further proof for the existence of retinal acid mucopolysaccharides and more information concerning their chemical nature were deemed essential. For this purpose, substances isolated from beef retina have been investigated on the basis of paper electrophoresis, ethanol solubility, hexosamine and hexuronic acid content, and evidence for two types of acid mucopolysaccharides found. Stepwise ethanol precipitation and column chromatography have been compared as usable methods for separating these isolated retinal compounds for more extensive study.

MATERIALS AND METHODS

Beef eyes were incised at approximately 0.25 inch posterior to the limbus and the contents allowed to fall free from the posterior segment. The retina which remained in place was teased out and freed from its attachments. Retinas were pooled in three batches of 50 each (designated RP_I, RP_{II}, and RP_{III}), homogenized in cold acetone, and the insoluble materials were air dried.

* From the Department of Ophthalmology, School of Medicine, Washington University. This investigation was supported in part by research grant B-1375 from the National Institute of Neurological Diseases and Blindness of the National Institutes of Health, Public Health Service.

† Retinal mucopolysaccharides have been observed and localized by histochemical methods by others. Personal communication, Dr. P. Cibis, Department of Ophthalmology, Washington University, Saint Louis, and Zimmerman, L. E., and Eastman, A. B.: Abstract in *Am. J. Ophth.*, 45:723, 1958.

Isolated and purified acid mucopolysaccharide preparations were obtained from the acetone powders according to the method described by Meyer et al.²

Retinal acid mucopolysaccharides were isolated on the basis of ethanol solubility and demonstrated on the basis of paper electrophoretic mobility compared to reference standards; metachromatic staining with toluidine blue, hexosamine and hexuronic acid content. The techniques employed for paper electrophoresis and for metachromatic staining of the substances on paper are similar to those previously described.³ Hexuronic acid was measured by the carbazole method⁴ and hexosamine by a modification* of a method described by Roseman.⁵

Isolated retinal acid mucopolysaccharides were further fractionated by two procedures based on ethanol solubility.

Procedure A. The retinal acid mucopolysaccharides were treated with 10, 20, 30, 40, and 50-percent ethanol by a stepwise increase in alcohol concentration. At each step the precipitate was allowed to form overnight at 4°C. The precipitable substances were observed by paper electrophoresis and for metachromasia.

Procedure B. A gradient elution of isolated retinal acid mucopolysaccharides from a cellulose column similar to the type described by Gardell⁶ was used. The isolated retinal material was taken up in 0.3 percent solution of sodium acetate and layered on a cellulose column (1.5 by 20 cm., Whatman standard grade) which had first been equilibrated with 0.3-percent solution of sodium acetate in 80-percent ethanol. The starting eluent was approximately 150 ml. of 0.3-per-

* Personal communication from Dr. J. L. Strominger, Department of Pharmacology, Washington University, Saint Louis.

cent solution of sodium acetate in 80-percent ethanol which was then diluted by 0.3-percent water solution of sodium acetate. Five-ml. fractions were collected at an approximate rate of 10 ml. per hour. The amount of hexuronic acid in each collected fraction was measured. The fractions were then pooled according to the major peaks observed, concentrated, dialyzed against distilled water, and assayed for hexosamine and hexuronic acid, and further observed by paper electrophoresis and metachromatic staining.

RESULTS

STEPWISE ETHANOL FRACTIONATION

In these experiments stepwise fractionation was attempted as a means of separating the two metachromatic staining substances seen in RP_I (fig. 1). No precipitable material was observed at 10- and 20-percent ethanol concentrations but was obtained in 30-, 40-, and 50-percent ethanol. Paper electrophoretic mobilities of nonfractionated (RP_I) and fractionated (RP_{II}) isolated retinal acid mucopolysaccharides were compared with chondroitin sulfate (CS) and keratosulfate (KS) reference standards. Two metachromatic staining substances with electrophoretic mobilities similar to that of CS and KS were seen in RP_I . The 30-, 40-, and 50-percent ethanol fractions contained a metachromatic substance with an electrophoretic mobility similar to that of CS. In addition, a substance of high electrophoretic mobility appeared in the 40- and 50-percent ethanol fractions, while the substance of low electrophoretic mobility appeared in the 50-percent ethanol fraction.

CELLULOSE COLUMN ELUTION

Hexuronic acid analysis of fractions eluted from the column (measured as glucuronic acid) indicated the tubes containing isolated retinal acid mucopolysaccharides (fig. 2). Three major peaks were observed, and the collected fractions were pooled into five groups as follows: (a) 5-16; (b) 17-31; (c) 32-43; (d) 44-62; (e) 63-106 (table 1). Molar ratios of hexosamine to hexuronic



Fig. 1 (Wortman). Paper electrophoretic mobility of metachromatic (toluidine blue staining) material in acid mucopolysaccharides isolated from beef retinas. The first preparation (RP_I) contained two substances with paper electrophoretic mobilities similar to chondroitin sulfate (CS) and keratosulfate (KS) reference standards. The second preparation (RP_{II}) was precipitated with 30-, 40-, and 50-percent ethanol. The isolated mucopolysaccharides and reference standards were applied to Whatman No. 1 paper, electrophoresed in 0.05 M phosphate buffer, at pH 6.8, for two hours at a voltage gradient of 10 V/cm. and then stained with toluidine blue.

acid (measured as galactosamine and glucuronic acid) varied with the pooled fractions and suggested that a mixture of acid mucopolysaccharides was extracted and isolated from beef retina.

By comparison of data in Figures 2 and 3, the component of low electrophoretic mobility found in RP_I and RP_{II} (fig. 1) was

TABLE 1

HEXOSAMINE AND HEXURONIC ACID ANALYSES OF CELLULOSE COLUMN FRACTIONS

Acid mucopolysaccharides isolated from beef retinas were applied to a cellulose column (1.5 by 20 cm., Whatman standard grade) and resolved by an ethanol gradient elution. Five-ml. fractions were collected at a rate of 10 ml./hr. and pooled according to the major peaks observed after hexuronic acid analysis of these fractions. The following analyses were made after concentration and dialysis of the pooled fractions. Hexosamine was measured after hydrolysis in 4 N HCl for six hours at 100°C. Hexosamine and hexuronic acid were measured as galactosamine and glucuronic acid and concentrations expressed in mM/l.

Fractions*	Hexosamine	Hexuronic Acid	Hexosamine:Hexuronic Acid (molar ratio)
a. 5-16	0.20	1.72	0.12
b. 17-31	6.68	3.81	1.75
c. 32-43	2.16	2.11	1.02
d. 44-62	0.24	0.34	0.71
e. 63-106	0.04	0.55	0.07

* Letter system denotes paper electrophoretic fractions shown in Figure 3, and number system is the same as that used in Figure 2, for the cellulose column fractions.

probably the same compound found in the second major peak (fig. 2) and demonstrated as the metachromatic staining substance in pooled fraction "b" (fig. 3). This was the substance of high ethanol solubility. The component of high electrophoretic mobility (fig. 1) was found in the third major peak (fig. 2) and demonstrated as the metachromatic staining material in pooled fractions "d" and "e" (fig. 3). The concentrated sub-

stance obtained from the first major peak (fig. 2) was viscous and did not demonstrate any visible metachromasia (fig. 3).

DISCUSSION

On the basis of paper electrophoretic mobility, at least two metachromatic staining substances could be demonstrated in preparations of acid mucopolysaccharides isolated from beef retina. One component showed an electrophoretic mobility similar to chondroitin sulfate and the other similar to kerato-sulfate reference standards. Paper electrophoretic mobility per se cannot be used as a means of identifying these metachromatic materials, because the mobility is in part dependent upon the charge, configuration, and size of the molecule. The problem at this point was to separate the two components so that further identification of each could be accomplished. If these two components differed in molecular size, they could be separated on the basis of alcohol solubility. Stepwise ethanol fractionation demonstrated that some separation could be accomplished, although the component with the slower electrophoretic mobility could not be precipitated free of all the fast-moving component by this method. It was for this reason that a gradient column was attempted.

A cellulose gradient column appeared to be the better means of resolving isolated beef retinal acid mucopolysaccharides into the

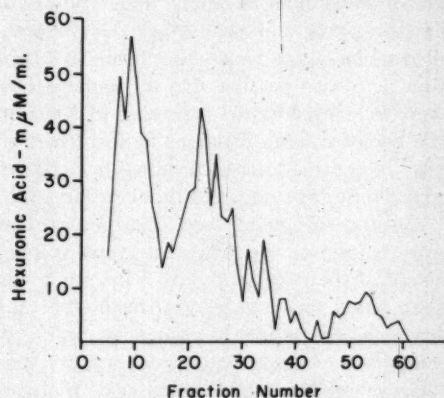


Fig. 2 (Wortman). Approximately 35 mg. dry weight of acid mucopolysaccharides (RP_{III}) isolated from beef retinas were placed on a cellulose (Whatman standard grade) column (20 by 1.5 cm.) and gradient elution by a solution of 0.3-percent sodium acetate in water dripped into a starting solution of 0.3-percent sodium acetate in 80-percent ethanol. Five-ml. fractions were collected at a rate of 10 ml. per hour. Hexuronic acid was measured as glucuronic acid.



Fig. 3 (Wortman). Demonstration of metachromatic staining material and paper electrophoresis of acid mucopolysaccharides isolated from beef retinas and resolved on a cellulose column. The pooled fractions "a" through "e," corresponding to those listed in Table 1, were spotted on Whatman No. 1 paper and electrophoresed in 0.05 *M* phosphate buffer at pH 6.8 for two hours at a voltage gradient of 10 V/cm. and then stained with toluidine blue. Reference standards are heparin (HP), chondroitin sulfate (CS), keratosulfate (KS), and hyaluronic acid (HA) isolated from beef vitreous.

two major components. The exponential gradient used in these measurements caused the first two major peaks to crowd together and the third one to spread out. A linear or different type of exponential gradient will be used in future studies. The nature of the hexuronic acid containing material in the first major peak is not understood. No explanation for its lack of metachromasia can be given at this time. More information rela-

tive to paper electrophoretic mobilities and metachromatic staining may be gained after quantitative analyses of hexosamine, hexuronic acid, and sulfate contents are performed.

Treatment of the nonfractionated isolated acid mucopolysaccharides with testicular hyaluronidase indicated that the electrophoretically slow-moving component was hydrolyzable while the fast-moving component was not. This suggested that the two substances are different materials and not necessarily one substance which had depolymerized. The action of hyaluronidase also ruled out the possibility that the slow-moving component was keratosulfate and the other chondroitin sulfate A and/or C. Keratosulfate and chondroitin sulfate B are resistant to the action of hyaluronidase while chondroitin sulfate A and/or C are not. The possibility that the fast-moving component is chondroitin sulfate B cannot be eliminated by these measurements.

Ninhydrin oxidation of the pooled cellulose column fractions after acid hydrolysis suggested the presence of galactosamine and glucosamine in all fractions.⁷ If a mixture of amino sugars and uronic acids is present, then molar ratios would be difficult to interpret. It is also possible that the molar ratios were influenced by the resistance of some of the pooled column fractions to acid hydrolysis. This would have resulted in lowered molar ratios and needs further consideration.

Ground substances have been observed in gray matter of the central nervous system. Proof of their existence and distribution has been based on histochemical methods.⁸ Embryologically retina is related to brain. A comparative study of acid mucopolysaccharides in brain and retina may be more meaningful than a comparison with other parts of the eye.⁹

SUMMARY

Beef retina has been analyzed for its acid mucopolysaccharide content. On the basis of paper electrophoresis and metachromatic

staining of material isolated from these retinas two compounds have been detected. These compounds exhibited paper electrophoretic mobilities similar to chondroitin sulfate and keratosulfate reference standards. Treatment with testicular hyaluronidase indicated that one electrophoretic component was sensitive to this enzyme while the other was not. This eliminated the possibility that keratosulfate or chondroitin sulfate A and/or C were being dealt with. An attempt to separate the two components was made on the

basis of ethanol solubility. Stepwise precipitation and cellulose column elution techniques were used. The latter method was found to be the better. The compounds eluted from the column were found to contain hexosamine and hexuronic acid. Further studies will be conducted in order to gain more information relative to the chemical nature and possible role of these compounds in retinal pathology.

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THE EFFECT OF LIGHT ON THE LEVEL OF REDUCED GLUTATHIONE IN RETINAL HOMOGENATES*

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Since Boll¹ observed the bleaching of the retina in light, much attention has been paid to changes which light energy initiates in the retina. Research workers, especially those belonging to the American^{2,3} and the English^{4,5} school, have arrived at very valuable conclusions but so far the mechanism of vision remains obscure.

While investigating the biochemical problems of the retina,⁶ we were concerned with the exploration of the quantitative changes of the substances with sulfhydryl groups in bovine retinal homogenates due to exposure to light. The polarographic method⁷ has been utilized, for it enables us to carry out the investigations of these substances in native homogenates.

MATERIAL AND METHODS

The determination of the amount of substances with sulfhydryl groups, designated as reduced glutathione (GSH), was carried out by the help of polarography; this technique

* From the Department of Ophthalmology of the Medical Faculty (Director: Prof. Dr. V. Vojdovský) and the Chemical Institute of the Medical Faculty (Director: Prof. Dr. F. Santavý), Palacký University. This paper is the fifth communication of the series "On the metabolism of glutathione and related substances." (For the fourth paper see Pflügers Arch. ges. Physiol. **266**: 473, 1958.)

is based on the comparison of the height of the anodic polarographic curve which is directly proportional to the concentration of the sulfhydryl substances.⁷

For all the experiments bovine retinas have been used. Directly after the animals had been killed the whole eyeballs were removed, immediately cooled to +4°C. and then left to stand in the dark at this temperature until the time when the determination was carried out. Shortly before the experiment the retinas were dissected from the eyeballs (four to six in number), homogenized with sea-sand, and diluted at the rate of about one to three with the modified Tyrode solution⁷ (resulting pH of about 6.7). The oxygen was removed by bubbling with hydrogen and the polarographic curve recorded. All these procedures have been performed either in the dark or in a very dim red light at room temperature. Then directly in the polarographic vessel the homogenate (slowly and continuously bubbled with hydrogen) was exposed for 10 minutes to the light of a 200 watt bulb of blue glass (the so-called daylight) at a distance of about one meter, and the polarographic curve again recorded.

The polarographic measurements were carried out by using a Heyrovský polarograph, utilizing a Kalousek¹² vessel with a separate saturated calomel reference electrode. The waves were recorded at the anodic-cathodic branch from -0.50 v in reverse, at 200 mV/absc. For more detailed information regarding the character of the anodic wave formed by GSH under our experimental conditions see reference 8.

RESULTS

When bovine retinal homogenates are prepared and polarographed in the dark they give a well-defined anodic wave which corresponds with the curve yielded by the homogenates of other animal organs⁹ and is characteristic of substances bearing free sulfhydryl groups—probably the greater part of them being GSH.⁸ Exposure of the homogenate to the light of a bulb for 10

TABLE 1
RISE OF THE GSH LEVEL IN THE RETINAL*
HOMOGENATE AFTER EXPOSURE TO LIGHT

Storage (in hr.)	GSH (in mg.%)		Rise (in %)
	In the Dark	After Ex- posure to Light	
3	62.5	71.0	+13.6
6	39.4	45.8	+16.3
8	38.1	42.5	+11.5
24	25.3	28.7	+13.4
27	15.7	17.5	+11.5
48	16.2	18.7	+15.4

* The retinal samples were stored at +4°C. for different lengths of time. All the samples show practically the same percentage rise of the GSH level after exposure to light.

minutes leads to a distinct increase in the height of the wave (fig. 1). Calculation of the GSH concentration in the retina from the records showed an increase which, on the average, amounted to 13 percent of the value obtained in the dark. This percentage rise is practically the same in the homogenates of the retinas investigated directly after the animal has been killed and in those dissected from the eyeballs which were stored for a certain time (up to 48 hours) at +4°C. in the dark (table 1). But the absolute GSH content decreases during storage (diagram 1).

In order to eliminate the possibility that the rise of the GSH content in the retinal homogenate takes place without its being exposed to light, we investigated the GSH content of the homogenate which was kept in a polarographic vessel in the dark for a given time and only then exposed to light. One typical experiment of this kind has been presented in Diagram 2. It is to be seen from this diagram that in the dark the GSH level of the retinal homogenate undergoes practically no changes but that after exposure to light a distinct rise is observed.

In addition we tried to investigate the effect of a longer exposure to light on the GSH level in the retinal homogenate. Diagram 3 shows a parallel between extension of the time of exposure to light and increase

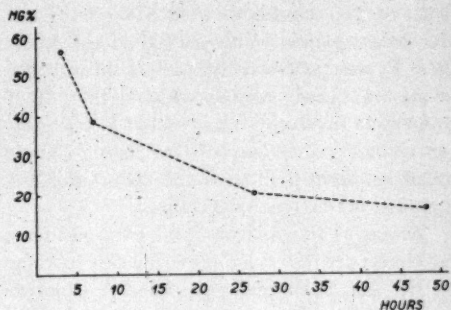


Diagram 1 (Dolének and Černoch). Reduction of the GSH level in the retinal homogenates is dependent on the length of time during which the eyeballs have been stored. Directly after the animals had been killed the eyeballs were cooled to $+4^{\circ}\text{C}$. and stored in the dark. The retinal homogenates were prepared and polarographed in the dark and at room temperature.

of the GSH content. Within the first few minutes it increases more rapidly and then the progress slows down. This lasts for an hour; subsequently a decrease again follows, the reasons for which may be various and nonspecific.

For the sake of comparison we have undertaken to find out whether light exerts any effect on the GSH level of the homogenates obtained from other parts of the eye, namely, the lens and the choroid with the ciliary muscle, respectively. There was no signifi-

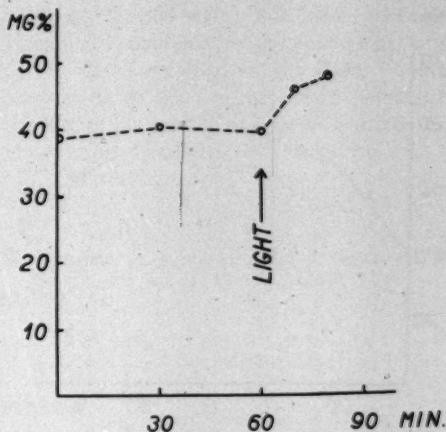


Diagram 2 (Dolének and Černoch). The changes of the GSH amount in the homogenate occurring in the dark and after exposure to light. The homogenate was prepared and polarographed at first in the dark; at the time indicated by an arrow, the exposure to light was commenced (200 watt Westinghouse bulb of blue glass at a distance of 1.0 m.).

cant rise of the GSH level observed in any of these homogenates after exposure to light.

DISCUSSION

Let us consider somewhat closer the adequacy of the material and the method in use. We are well aware of the fact that an interruption of the circulation must lead to a preponderance of the catabolic processes in the

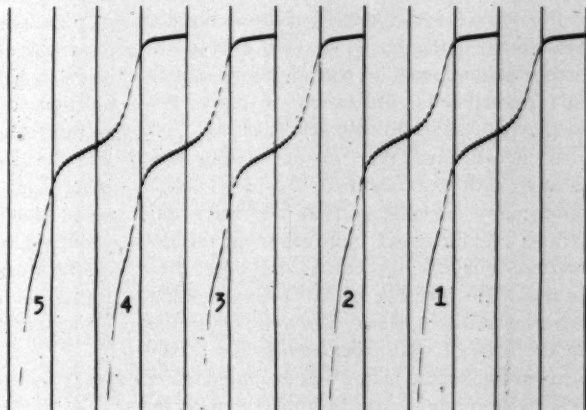
Fig. 1 (Dolének and Černoch). Variation in height of the polarographic waves of GSH of retinal homogenates in the dark and after exposure to light.

(Curve 1) Bovine retinal homogenates prepared and polarographed in the dark.

(Curve 2) The same homogenate after 10 minutes in the dark.

(Curve 3) The same homogenate after 10-minute exposure to light (200 watt Westinghouse bulb of blue glass at a distance of 1.0 m.).

(Curves 4 and 5) The same homogenate left to stand in the dark for 10 or 20 minutes, respectively, and then polarographed.



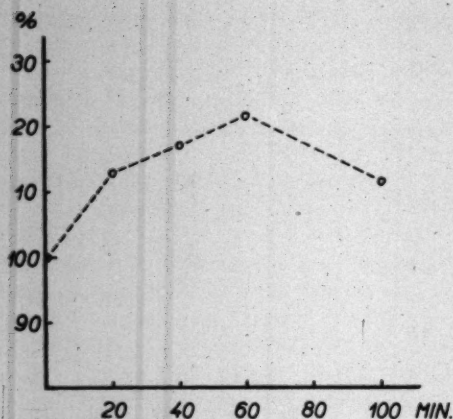


Diagram 3 (Dolének and Černoch). The changes of the GSH amount in the retinal homogenate after long exposure to light. The homogenate was prepared in the usual way. The GSH concentration in the dark was taken as 100 percent. The changes occurring due to exposure to light were then calculated as percentage of the values in the dark.

retina which evidences a very intense metabolism. Cooling of the enucleated eyeballs to $+4^{\circ}\text{C}$. slows down the processes considerably but does not stop them completely. The following homogenization results in destruction of the structure of the retina and of its cells. This is shown to be a definite interference in the metabolic process as is well known, for example, from the report by Kornblueth, et al.¹⁰ who found that after homogenization the ability to utilize glucose in the retina is lost. From this follows that the conditions in the retina *in vivo* and in the homogenate cannot be considered as identical; nevertheless, utilization of native homogenates has its advantages.

It is assumed that in the homogenate diluted with the modified Tyrode solution only, many enzymic systems and their substrates remain intact, thus allowing the numerous enzymic processes to take their course. The inability of the retinal homogenate to utilize glucose was a welcome fact in the case of our experiments, for in this way an important factor was excluded which otherwise might seriously interfere with the

level of the substances with SH-groups under investigation. With the aid of the modified Tyrode solution the pH of the homogenate was fixed (namely, next to the pH of the retina *in vivo*), for it would also undergo changes when exposed to light.¹¹ These changes might then be found reflected in the quantity of active SH-groups.

As far as the polarographic method in use is concerned it is not quite specific for the GSH⁸ but it is a technique which enables us to determine the substances with sulfhydryl groups under native conditions, that is, without prior denaturation of the proteins and enzymes and without any other rough interference with regard to the physiologic conditions (except for the homogenization mentioned above). This renders the method especially suitable for our purpose because it enables us to determine the GSH content before and after exposure to light in one and the same retinal homogenate. Thus a considerable reduction of the effect of the biologic variability on the evaluation of the experimental results is achieved.

Wald and Brown² found that exposure of rhodopsin to light leads to a rise of the amount of active sulfhydryl groups whose determination has been carried out with the help of amperometric titration with silver nitrate. The results of our experiments show that this rise occurs in the homogenate of the whole retina as well and consequently not only in the isolated rhodopsin. In addition it is suggested that the method in use is a more specific one for the determination of sulfhydryl groups than titration with silver nitrate, in which case it cannot be guaranteed that the silver ions do not get bound to some other functional groups. We, therefore, assume that the substances with sulfhydryl groups play an important role in the biochemical processes which take place in the retina on exposure to light and therefore even in the process of vision itself.

SUMMARY

With the help of the polarographic method

the effect of light on the amount of reduced glutathione contained in the homogenate of bovine retinas has been investigated. It was found that exposure to light led to a rise of the level of reduced glutathione (or the substances with active sulfhydryl groups, respectively), that is, after exposure to the

light of a 200-watt bulb, the increase amounted approximately to about 13 percent of the value obtained in the dark. In the other parts of the eye there does not occur any rise of the content of reduced glutathione after exposure to light.

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OCULAR COMPLICATIONS OF MULTIPLE MYELOMATOSIS*

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Multiple myelomatosis is a disease characterized chiefly by the proliferation in the bone marrow of hypermature plasma cells. Although the plasma cells may be found in other organs and in the lymph nodes, the typical bone-marrow changes are of important diagnostic significance. Plasma cells replace the normal erythrocyte-forming tissue.

The etiology of this disease is unknown. It usually occurs at about middle life and most frequently between 50 and 60 years of age. The most common sites for the lesions to occur are the vertebrae, ribs, cranial bones, humerus, and femur.

SIGNS AND SYMPTOMS

The most prominent symptom is intermittent pain which may be of a rheumatic

variety and which is localized according to the site of the lesion. The spine is a common location and the pain is aggravated by motion. Spinal involvement may also be accompanied by neurologic symptoms and evidence of paralyses. Pathologic fractures affecting the ribs are not infrequent. Bronchitis, emphysema, and pneumonic infections are common. Anemia and cachexia are prominent features and a strong tendency for hemorrhage to occur is often present.

LABORATORY FINDINGS

According to Martin and Johnson¹ about 60 percent of these patients reveal the presence of Bence-Jones protein in the urine. In nearly all of the cases, a proteinuria will be found sometime during the course of the disease. The presence of myeloma cells is accompanied by abnormal globulins in the blood. The total protein may be normal, but albumin is reduced and the globulin increased. The anemia may be the most promi-

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It is with regret that THE JOURNAL learns of the death of Dr. Donnelly on October 11, 1958.

nent early feature of the disease. The total white count may be unaltered, but leuko-erythroblastic anemia may occur and plasma cells may be found in the peripheral blood. An altered blood chemistry was also described with increase of serum calcium because of the bone destruction. Serum phosphorus, cholesterol, and alkaline phosphatase are normal and blood urea nitrogen is elevated in the terminal stages with renal failure.

DIAGNOSIS AND COURSE

The diagnosis of multiple myeloma depends chiefly on the X-ray changes in the bones, the blood changes, urinary changes, and especially the Bence-Jones protein in the urine. The X-ray studies of the bones reveal the true lesions in the involved areas. These are characterized by small, punched-out osteolytic areas which are usually round or oval and may vary in number. They resemble small cysts in appearance. In many cases the X-ray findings may reveal a generalized demineralization of bone.

This disease must be differentiated from carcinomatosis; however, in carcinomatosis it is more common for a primary tumor to occur with metastasis to the lungs. The X-ray findings and Bence-Jones protein may be identical in both conditions. A bone-marrow biopsy, however, will aid in differentiating the two.

The course of the disease is progressive and it usually terminates fatally after one or two years. There is no known specific treatment, although during the past two or three years urethane has been employed with some benefit in prolonging the life of the patient and improving the condition of the blood and urine.² Corticotropine, cortisone, and urethane have also been employed in combination, with beneficial results in reducing the number of myeloma cells in bone marrow, lowering the concentration of abnormal proteins in the blood, and arresting the progress of lesions in the bones.³

OCULAR INVOLVEMENT

There have been comparatively few reports in the literature describing ocular lesions occurring during the course of multiple myelomatosis. In 1955, Handousa⁴ reported a case of proptosis in a 50-year-old man with multiple myelomatosis. The changes in the bones and Bence-Jones protein reaction in this case were typical of the disease.

Cacco and Pende⁵ described the fundus changes in 10 cases to be numerous and deep choroidal hemorrhages which resembled drusen or vacuoles. They felt that impaired coagulation time, thrombocytopenia, hyperazotemia, and toxic endothelial changes were responsible factors.

Tumors consisting of plasma cells have been described as occurring in various structures of the eye by a number of authors. Plasmocytoma of the orbit was reported by Jim⁶ in a 60-year-old white woman who was successfully treated with surgery and X-ray therapy but he mentioned no other clinical evidences of myelomatous disease.

Danis, Brauman, and Coppez⁷ described the ophthalmoscopic lesions in two cases of multiple myeloma with cryoglobulinemia. They found marked widening and tortuosity of the retinal veins as well as diffuse superficial and deep retinal hemorrhages. Some of these were associated with a few whitish exudates. There was also sludging of arterial and venous blood on compression of the globe and a variable reduction of visual acuity.

Retinal hemorrhages, central retinal artery and vein thrombosis, as well as orbital myeloma and other complications, were also described by Clarke.⁸

The occurrence of myelomatous infiltrates within the vascular and fibrous tunics of the eyes were recently reported by Brownstein.⁹ He considered this to be the first case in which such infiltrates in the ocular tissues was described. Myeloma cell infiltration was found at autopsy in the sclera, choroid, and

iris. The bone marrow of this patient, who was a 50-year-old Negress, showed 17-percent plasma cells and a consistent Bence-Jones proteinuria. The serum albumin was 4.6 gm./100 cc. and serum globulin 1.0 gm./cc.

A recent case was reported by Rose and Taylor,¹⁰ in a woman, aged 56 years, with marked nonpulsating proptosis of the left eye. X-ray films showed the whole vault of the skull rarefied. Sternal marrow showed cells of the plasma series. Autopsy showed tumor mass with hemorrhage behind the eye.

REPORT OF A CASE

The patient, a married woman, aged 65 years, was first seen at Wills Eye Hospital on May 8, 1957. She stated that she had suddenly lost the vision in the right eye one year previously. She was examined in the small town where she lived and was told that she had suffered a severe hemorrhage in the right eye. She never recovered any vision in this eye. Several months later she noticed what she called "soot" drifting before the vision of the left eye. She returned to her physician at home and was told that she had now suffered hemorrhages in the left eye. The vision in this eye became worse and she also complained of pain in the right eye with burning and itching in both.

Eye examination. She was admitted to the hospital, May 8, 1957, and ocular examination showed the following:

O.D.: There was no light perception present. O.S.: Vision of hand movements only. Ocular tension: O.D., 40 mm. Hg; O.S., 26 mm. Hg (Schiotz). The lids of both eyes were normal; rotations full in all directions. Conjunctiva and cornea were clear. The anterior chamber was deep in each eye. Pupil in the right eye was about five mm. in diameter, irregular in outline, and failed to show any reaction to direct light. Several specks of iris pigment could be seen on the anterior capsule of the lens. In the left eye the pupil was about five mm. in diameter, very slightly irregular in outline, and reacted very weakly to direct light.

Ophthalmoscopic examination. There was a very faint fundus reflex obtained in the right eye and the pupillary space was occupied by what appeared to be a secondary cataract. No details of the fundus could be seen. The left eye also revealed only a faint fundus reflex. The center of the lens was cloudy and no details of the fundus could be seen.

Slitlamp examination. O.D., the cornea appeared to be slightly edematous with a fine cellular debris scattered over the endothelial surface. There was a rather dense flare but few cells were seen in the aqueous. The iris showed areas of patchy atrophy and almost complete posterior synechia. There was

cortical and nuclear opacification of the lens. O.S., showed a fine cellular debris on the endothelium, a faint aqueous flare, and some diffuse iris atrophy. There was some nuclear sclerosis and cortical changes in the lens.

The ocular diagnosis made at this time was O.D.: (1) Old vitreous hemorrhage; (2) possible anterior uveitis; (3) secondary glaucoma; (4) iris atrophy. O.S.: (1) Hemorrhagic retinopathy with possible involvement of the vitreous; (2) immature cataract formation; (3) iris degeneration and atrophy.

During her stay in the hospital, the ocular condition remained unchanged with the intraocular pressure varying from about 28 to 40 mm. Hg in the right eye and 17 to 26 mm. Hg in the left eye.

General physical examination. May 19, 1957 (Dr. Hanno). The patient stated she had been receiving no medication prior to admission to Wills Hospital. There was no history of high blood pressure, diabetes, or cardiac disease. She had suffered three attacks of herpes zoster in the past and gave a history of appendectomy, hysterectomy, and a diaphragmatic hernia.

The appearance of the patient was somewhat aged, depressed and slightly emaciated. She complained of rather vague "arthritic" pains in the back and lower extremities especially, but examination elicited no acute bone pain. There was no adenopathy present but the liver and spleen were palpable. Blood pressure was 112/62 mm. Hg. Examination of the heart and lungs revealed no abnormalities. Abdomen was soft and there was no edema present. There was an old posterior thoracic scar and two old abdominal scars. The electrocardiographic examination showed a normal sinus rhythm and the tracing was essentially within normal limits.

At this time another examination of the eyes under the slitlamp was made and a definite blood sludging could be observed in a small vessel coursing over the lens capsule in the right eye. Since this phenomenon and the agglutination of red cells observed in the laboratory in this case often occur together in cases of multiple myeloma, a sternal marrow aspiration was performed immediately.

Report on sternal bone marrow. "This shows a moderate hypercellularity. About 20 to 30 percent of cells are plasma cells, most of which show some degree of immaturity. There was no immaturity of granulopoiesis and erythropoiesis was normoblastic. The mature red cells showed marked agglutination and a very characteristic greasy appearance. The sternal bone marrow findings are diagnostic of multiple myeloma."

X-ray examination of the skull showed the skull and orbits to be normal although there was calcification of the falx cerebri and marked hyperostosis frontalis interna. There was diffuse clouding of the left maxillary antrum but the bones in and around the orbits and sinuses were normal.

Laboratory findings. Urine negative for albumin and sugar. Reaction alkaline. Specific gravity 1.020 and showed one WBC and one epithelial cell. The

urine showed a positive Bence-Jones reaction. Blood coagulation time: 11 min. Bleeding time: 1.0 min. 15 sec. Prothrombin time: 25/16. Blood sugar: 66 mg. Wassermann: negative. Clot retraction: 1.0 hr. rimmed, 2.0 hr. rimmed; no retraction 24 hours. CBC: Hb. 7.5 gm. (48; RBC 2,940,000; WBC 7,500, polys 72; eosin. 8.0 percent (high); lymphocytes 15 percent; mono. 5.0 (a little high), platelets 197,000. (Marked anemia about 50 percent and eosinophilia.) Serum albumin and globulin: Total protein 11.0 albumin 1.8; globulin 9.2. (Serum albumin-globulin in inverse ratio.)

The routine blood studies showed a marked tendency to hemo-agglutination. Based on the results of these findings, especially the bone marrow and blood examination, the diagnosis of multiple myelomatosis was confirmed. The patient was discharged from this hospital on May 14, 1957, to her private physician for treatment of this condition in a general hospital in her home town. She was placed on treatment with urethane one gm. three times daily, gradually increasing to two gm. to be continued indefinitely if tolerated.

Her subsequent course was rather stormy. After being hospitalized for three weeks at home, she developed another attack of "shingles," and also complained of pains in the eyes, head, and face. She received three blood transfusions.

She returned for a re-examination of her eyes on September 12, 1957, and their condition was found to be unchanged. The blood count at this time was only slightly improved. In December, 1957, the patient developed aneuria and a confused mental state for which she was re-admitted to her home-town hospital and on January 2, 1958, she died of what the local physician diagnosed as a cerebral accident. No autopsy was performed.

SUMMARY AND CONCLUSION

Presented was a case of previously undiagnosed multiple myelomatosis occurring in a patient who came to Wills Eye Hospital because of almost total loss of vision in both eyes. A brief review of this disease and its ocular complications has also been presented.

On admission, the results of the blood examinations, hemoagglutination, and blood sludging indicated the possibility of multiple myeloma. The examination of sternal bone-marrow aspiration, showing from 20 to 30 percent of plasma cells, confirmed this diagnosis. The patient also suffered from an anemia of about 50 percent and showed Bence-Jones proteinuria, as well as a proteinuria with albumin-globulin in inverse ratio.

The ocular complications were vitreous hemorrhages in both eyes, more marked in the right eye and apparently following earlier retinal hemorrhages; anterior uveitis in the right eye with secondary glaucoma and immature cataracts in both eyes. The disease ran the usual course and terminated fatally about one and a half to two years after onset.

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PSEUDOTUMOR CEREBRI*

OR BENIGN INTRACRANIAL PRESSURE

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Nonne¹ described, in 1904, 10 cases of increased intracranial pressure which resolved spontaneously or under treatment with iodine preparations. He was the first to name this disease "pseudotumor cerebri." Pseudotumor cerebri is a condition in which there is increased intracranial pressure with no presence of the intracranial neoplasm. The onset is insidious and the patients appear in good health; alertness is a characteristic feature. The salient signs are: papilledema which is invariably bilateral; sometimes as much as five or six diopters of elevation. Frazier² reported that one of his patients with pseudotumor cerebri had 11 diopters elevation of the discs.

Headaches, the first symptom, are frequent. Paralysis of one or both abducens nerves is common. The spinal fluid is under increased pressure, but its cell count and protein content are normal. Ventriculography reveals that the ventricles usually are small and symmetrically placed as if they were compressed by general swelling of the brain or by excessive fluid in the meninges (Ford and Murphy³). Vomiting and drowsiness are present in some cases.

The visual acuity is reported to be impaired to a greater degree in pseudotumor cerebri than in elevated intracranial pressure due to a neoplasm. Walsh⁴ reported a boy, aged 12 years, in whom the vision was reduced to light perception. In Dandy's^{5,6} group of 22 cases, the impairment of vision was present in 50 percent. In Finkelburg's⁷ 22 cases of pseudotumor cerebri, six patients were blind in both eyes. The loss of vision

usually is slow and gradual and recovery of vision is often more pronounced in one eye than in the other. The changes in the visual fields are not remarkable, except for enlargement of the blindspots due to swelling of the optic discs.

This syndrome usually occurs in young persons and terminates in spontaneous recovery in some patients. Zuidema⁸ states that the sex incidence shows a predominance of females in a ratio 3:1 in Dandy's⁶ material 3.7:1. The highest age incidence was found to fall in the 10- to 30-year group.

Other names given to the syndrome are: meningo-encephalitis serosa, serous meningitis, otitic hydrocephalus, arachnoiditis, all these characterized by chronic cerebral edema. A recent history of a head trauma, general infection, or otitis media is the underlying cause in some cases.

The various names given to this syndrome indicate that the true cause of this disease remains completely obscure. Davidoff and Dyke⁹ reported on a series of 15 cases of serous meningitis in nine of which there was no history of head trauma or infection. They commented on the "wet" appearance of the brain as a large amount of fluid was found in the subarachnoid space. Foley¹⁰ and Davidoff¹¹ called the syndrome "benign intracranial hypertension" because of the favorable outcome. Among Davidoff's¹¹ 61 reported cases, in 29 patients there was no history of injury or infection. Foley,¹⁰ McCullough,¹² and Thomas¹³ reported on cases in which increased intracranial pressure was observed in young, obese women and was associated with pregnancy, the menstrual period, or miscarriage.

Foley¹⁰ reviewed 60 cases. A large group of these consisted of obese women with a peak incidence in the third and fourth decade. In half of his cases paralysis of the sixth

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† A few hours after completion of this paper, Olga Sitchevska died of coronary occlusion. America loses a fine ophthalmologist and a deep student of our specialty, and THE JOURNAL regrets the loss of a good friend.

nerve was observed; in 57 cases there was papilledema of four or more diopters' elevation. The visual acuity was impaired in 19 cases due to central field defects and secondary optic atrophy. He assumed that in many of these cases an endocrine disturbance and an electrolyte imbalance could be in some way connected with the elevation of the intracranial pressure.

Bradshaw¹⁴ believes that the clinical picture and the small size of the ventricles are caused by an excess of cerebrospinal fluid over the convexity of the hemispheres. Among his reported 42 cases, 12 had bilateral palsies of the sixth nerve.

Sahs and Hyndman¹⁵ maintain that cerebral edema would be the most fitting diagnosis for this type of pseudotumor. Symonds^{16, 17} assumed that cerebral edema is caused by lateral sinus thrombosis with venous engorgement. He stressed the point that the absence of constitutional symptoms and focal signs and the presence of a normal cerebrospinal fluid favor the diagnosis of otitic hydrocephalus. He explained the common occurrence of paralysis of the sixth nerve as due to thrombosis of the petrosal sinus with compression of the abducens nerve by the clot. This might occur either by extension from the lateral sinus or by direct spread from the middle ear.

Ray and Dunbar¹⁸ developed a technique of dural sinus venography. They presumed that thrombosis of the dural venous sinuses is the cause of pseudotumor cerebri. They have been able to demonstrate thrombosis in the posterior half of the superior sagittal sinus or in a dominant transverse sinus with obstruction to the venous outflow of the brain as a cause of the syndrome. In one patient a thrombus was actually removed from the occluded sinus and only then did the symptoms subside. Recovery is dependent on the development of adequate collateral channels for venous drainage of the brain. Thus, Ray states that sinus venography might be helpful in establishing the diagnosis of "benign intracranial pressure."

Among Chandy's¹⁹ 604 cases, 20 showed no evidence of tumor, so they were classified as benign intracranial hypertension cases. Zuidema⁸ believes that since the syndrome of pseudotumor cerebri may be caused by a number of different pathologic entities, some of these cases should be classified as "idiopathic" cases of pseudotumor cerebri.

The prognosis of pseudotumor cerebri according to most observers is good. Many patients recover spontaneously or under conservative treatment. Zuidema⁸ in his study of 39 patients at The Johns Hopkins University from 1937 to 1953, found that they showed a relatively good long-term prognosis. He also followed up 12 available cases reported by Dandy⁵ in 1937; of these, 10 patients were still alive and well. Frazier² observed 22 patients classified as pseudotumor cerebri from two to 25 years, a period which is sufficient to exclude tumors proper and which indicates a favorable prognosis. The prognosis according to Davidoff^{11, 20} is excellent. Vail²¹ reported in 1939 that cure or improvement was obtained in 37 cases.

The important measure is the reduction of the intracranial pressure. In mild cases it can be done by limitation of fluid intake and increasing urinary output, salt poor diet, administration of Diamox or ammonium chloride. Lumbar punctures should be done with caution. In cases with severe headaches, the existence of papilledema resulting from pressure is a warning that vision is at stake and that the underlying cause must be removed as early as possible. Once vision is lost from intracranial pressure, it will not return. A right subtemporal decompression is performed. In the decompression the fluid is always coming from the subarachnoid space. After the decompression is done, the above medical measures can be resorted to. Davidoff¹¹ has done a right subtemporal decompression in most of his cases of pseudotumor cerebri with excellent results.

COMMENT

The outstanding objective finding in pseu-

dotumor cerebri is the presence of bilateral papilledema. Paralysis of one or both abducens nerves is common. Headaches in pseudotumor are less severe than those due to increased intracranial pressure of a comparable degree from brain tumors. Since the patient with bilateral papilledema is considered to be a brain tumor suspect, a ventriculogram is indispensable for the diagnosis and for the exclusion of a space-occupying lesion. It is well to emphasize that whenever vision is threatened in cases of pseudotumor cerebri a subtemporal decompression should be done without delay.

CASE REPORTS

CASE 1*

C. S., aged five years, eight months, was first seen on October 14, 1957, with a history of headaches and vomiting which coincided with her first school days, a month previously, and which lasted two weeks. At the end of September, her right eye became crossed. Since then the child favored the left eye and had to bring the objects close to her eyes in order to see. The child had to be awakened every morning for her school attendance while prior to that "she was the first to arise and to awaken the family." She also took a nap in the afternoon (not customarily done). There was no history of any illness; no earache or cold; the parents commented that she has been very healthy since birth. The examination showed a healthy, plump child, alert, rather garrulous, and ready to respond to questions.

The examination revealed an esotropia of the right eye; there was no motion of the right eye outward, that is, there was a paralysis of the right sixth nerve. There was no nystagmus. The vision was reduced to 20/100 in both eyes with no improvement. The pupils were round, reacted to light and accommodation, and were of equal size. Cyclogyl was instilled in both eyes and while the child was waiting for complete mydriasis, she fell asleep. The funduscopy revealed greatly swollen optic discs, from five to six diopters' elevation. The veins were markedly engorged, and there were multiple retinal hemorrhages scattered over the discs. The blindspots were enlarged, 12 by 15 mm.

Since there was a history of vomiting, drowsiness, and the objective findings of paralysis of the right abducens nerve, marked bilateral papilledema with retinal hemorrhages, I made a tentative diagnosis of an intracranial neoplasm. I referred the child immediately to a neurosurgeon (L. Davidoff) who admitted her at once to the hospital. The tentative

hospital diagnosis was: "midline cerebellar tumor."

Plain skull X-ray films revealed suture separation and slight demineralization of the dorsum sellae. The neurologic tests showed no gross motor or sensory deficit signs. On the second day of hospital admission a ventriculogram was done and the X-ray studies revealed very small, nearly collapsed ventricles but good visualization of the supracallosal sulcus in the normal position on the lateral views and prominent cortical sulci over both hemispheres. This was interpreted as ruling out an obstructing hydrocephalus and being consistent with pseudotumor cerebri and with no shift of the midline structures, thus effectively ruling out a supratentorial mass lesion as well.

A right subtemporal decompression, six cm. in diameter, was done on the same day. The dura was under markedly increased pressure and it was opened widely. The underlying brain appeared normal except for slight congestion of the cortical vessels. When the arachnoid was opened, a large amount of clear cerebrospinal fluid poured forth into the wound and the brain, immediately slackened, fell away and began to pulsate normally. During the closure of the wound the cerebrospinal fluid continued to well up into the field.

The postoperative course was uneventful. The paralysis of the right sixth nerve was less marked. Papilledema was still present. The patient was put on Diamox and a salt-free diet. The neurosurgeon's report was "pseudotumor cerebri."

The child was seen by me a month after her hospital discharge. There was still bulging of the decompression. The paralysis of the sixth nerve had disappeared and the ocular excursions were normal. There was present a slight edema of the optic discs; the retinal hemorrhages were absorbed; there was wrinkling of the retina at the macular region with lines of tension. The vision had improved to 20/70 in the right eye and to 20/50 in the left eye. The blindspots were still enlarged, and measured 12 by 15 mm.

The patient was last seen on May 16, 1958, seven months after the right subtemporal decompression was performed. The decompression site was well healed. The vision in the right eye was 20/50 and it was 20/40 in the left eye with no improvement with lenses. The blindspots measured 10 and 14 mm. The discs showed a slight pallor with wrinkling of the retina in the macular region and lines of tension were still present (fig. 1).

The child's behavior is normal and she does well at school. It may be assumed that the process has been stabilized and that no further impairment of vision will occur.

CASE 2†

M. R., a well-nourished, alert girl, aged seven years, was first seen on August 15, 1956, with the chief complaint of double vision. There was also blurring of vision of about eight months' duration. There was present a paralysis of the left lateral

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† Courtesy of Dr. John T. Simonton.



Fig. 1 (Sitchevska). Left eye, showing the fundus in a case of pseudotumor cerebri.

rectus. Fundus examination showed marked bilateral papilledema. The vision was correctible to 20/30 in the right eye and to 20/40 in the left eye. The blindspots were enlarged. The patient was admitted to Lenox Hill Hospital for a neurologic work-up, with a question of an intracranial expanding lesion in mind.

The lumbar puncture showed that the cerebrospinal fluid was under increased pressure but with a count of cells and a normal protein content. A ventriculogram was performed. The lateral ventricles and the third ventricle were quite well visualized and showed no evidence of dilatation, displacement, or deformity. The examination of the skull showed a rather marked degree of generalized increase in the convolutional markings probably indicating an increased intracranial pressure. The sella turcica was normal in size and configuration. The diagnosis was serous meningitis. The child was discharged in three weeks from the hospital.

In January, 1957, that is, in about a year after the onset of the blurring of vision, there was no

presence of papilledema. Peripheral normal fields with a slight enlargement of the blindspots: right eye 12.5 by 20 mm.; left eye 12 by 16 mm. In February, 1958, the central and peripheral fields were normal and the discs appeared normal. The vision in both eyes was 20/25 with correction. Thus, in this case there was spontaneous recovery, with no surgical interference.

SUMMARY

Two cases of benign intracranial pressure are reported. One patient, who had impairment of vision with marked bilateral papilledema and retinal hemorrhages, responded well to a right subtemporal decompression. However, there was present pallor of the optic discs due to secondary optic atrophy and the vision was reduced to 20/50 in the right eye and to 20/40 in the left eye. The second patient recovered spontaneously and had good vision and normal fields.

A partial review of the literature on the subject is presented. This was obtained from neurologic journals only. There were hardly any articles published in the ophthalmologic literature. I thought it worth while alerting ophthalmologists to the syndrome of benign intracranial pressure or pseudotumor cerebri, as they are likely to be the first to encounter these cases with failing vision and diplopia.

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THE INTERACTIONS BETWEEN LENS PROTEINS AND OTHER PROTEINS*

PART IV: THE BEHAVIOR OF THE LENS PROTEIN-PROTAMINE COMPLEXES IN RELATION TO ELECTROSTATIC AND ENZYMATIC ACTIONS: CHANGES ASSOCIATED WITH AGING OF THE LENS

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Much valuable information has been acquired during the last few years pertaining to the protein constitution of the lens. However, there are many uncertainties concerning protein metabolism of the lens, particularly those related to changes occurring with age.

Regarding the latter, while it has been known for some time that there is an increase in the albumoid fraction at the expense of the soluble protein, other and unexpected changes in the protein structure of the lens take place continuously from birth throughout life. Since some of these changes are likewise taking place in the development of cataracts, these studies are of more than biologic value.

In these investigations, electrophoresis has been most often used and hence studies of the lens proteins by this method pertain mainly to patterns, revealed by changes in the behavior of proteins in an electric field.

It has been shown by paper electrophoresis^{1,2} that at birth, in the lenses of all animal species, there are at least three protein fractions; the alpha and beta crystalline

fractions, which are well known from Mörner's classical studies (the homogeneity of the latter has been criticized by François and Rabaey)⁴ and a third fraction which has a very poor mobility and is not always identified with gamma crystalline whose existence has been placed in doubt by recent observations made by François et al.³ If some is present, it is present in negligible amounts. In man, monkey, rabbit, and perhaps in other species too, a fourth protein fraction may be detected, characterized by an intermediate mobility.

The third slowest fraction is present in the same amount as the first two fractions during the embryonic growth of the lens and retains its absolute value throughout life, whereas, percentage-wise, it is reduced, probably due to an increase in the other two fractions. In the adult the third fraction is to be found almost exclusively in the nucleus.^{3,5} These observations have induced François, et al.,⁶ to consider this third fraction as an embryonal protein, whose percentage reduction in the total extracts and even more in those extracts from the lens cortex, throughout life, as being due to the absence of further synthesis after birth, rather than a conversion

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of this third fraction into albumoid.

Dische, et al.,⁶ have succeeded in isolating by oxidation with FeCN from young lens extracts, a factor which gradually decreases throughout life and is thought to be the embryonal protein previously alluded to.

Other important changes in the soluble protein fractions of the lens detected by electrophoresis which occur with aging are:

1. A gradual reduction in the alpha crystalline (fast) fraction.^{7,8}

2. A parallel increase in the fraction of intermediate mobility (second fraction, beta crystalline).

3. A progressive overlapping or loss of specificity of the various bands, of which those relating to the alpha-crystalline fraction remain separable longer.^{2,9}

This loss of the electrophoretic specificity of the various fractions begins earlier in some species (man) than in others (horse) and is more pronounced in the superficial layers of the lens rather than in the nucleus.

The electrophoretic patterns detectable at birth for the other protein fractions are almost completely lost by the 10th year (man) so much that fractionation of the total extracts is hypothetical,⁸ although, in adults, a limited separation is possible from the superficial layers, at least for the alpha-crystalline fraction.

The physicochemical changes responsible in soluble lens proteins for the above electrophoretic effects are not as yet known. They may be due to changes in the protein molecule, as degradation or aggregation processes,⁷ or due to the presence in older lenses of proteins different from those present in younger lenses.⁸

The problems of chemical changes occurring in the lens proteins with age have also been investigated by Dische, et al.,⁶ who pointed out that the soluble lens proteins do not contain significant amounts of cystine while albumoid does contain as much cysteine as cystine. These authors also pointed out that throughout life the total amount of cysteine plus cystine remains constant in the

insoluble proteins, whereas in the soluble proteins, the amount of cysteine gradually decreases with age. They suggest that, with aging of the lens, there is a continuous oxidation of the soluble cysteine proteins (perhaps beta) which by further protein lysis and synthesis leads to the formation of albumoid. Oxidation of the SH groups seems to be important in the transformation of the soluble proteins to insoluble ones.

Sirchis, et al.,¹⁰ in the cat, found that the alpha-crystalline protein is similar to albumoid in such respects as sedimentation rate, electrophoretic mobility, and specific immuno-electrophoretic precipitation. They theorize that alpha-crystalline combines with an insoluble protein to form albuminoid.

This communication deals with the changes occurring in the lens with age, as studied by our method of interaction of the lens proteins with other colloids. Using this method we found:

1. When an electropositive protein is added to a total extract of lens from a young person at a pH of 7.0 at room temperature, a heavy precipitate occurs. Electrophoresis of the supernatant fluid showed a complete lack of alpha-crystalline range (fig. 1) proving that the precipitate contained all the alpha-crystalline-basic protein complex.

2. If serum is added to the above precipitate (obtained by protamine) and the resulting mixture treated by electrophoresis, the electrophoretic pattern shows an increased serum alpha-globulin range (fig. 2), indicating that the protamine originally added underwent a breakdown by serum-protaminase and that the alpha-crystalline resuspended in solution followed the serum alpha-globulins.

3. If heparin is added to the precipitate of insoluble alpha crystalline-protamine complex suspended in H₂O, a marked but incomplete clearing occurs. If this solution is centrifuged and the supernatant fluid is subjected to electrophoresis, the only range detected is that with an alpha-crystalline mobility pattern (fig. 3), proving that the alpha-

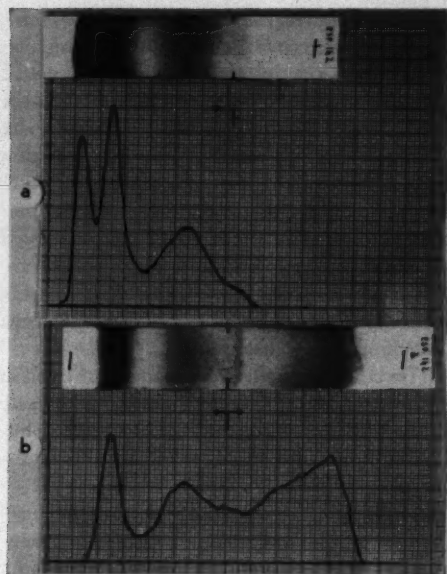


Fig. 1 (Orzalesi and Miglior). Electrophoretic patterns of normal young lens extract (A) before and (B) after protamine treatment. Arrows show direction of run from point of deposition: toward left, lens proteins; toward right, protamine excess.

crystalline-protamine complex was broken down by the electrostatic action of a polyelectrolyte (heparin) which was able to remove the alpha-crystalline from the complex

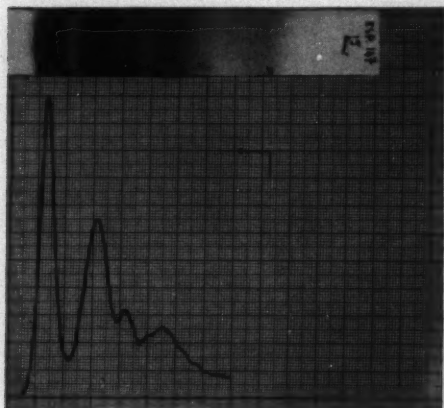


Fig. 2 (Orzalesi and Miglior). The electrophoretic pattern shows an increased serum alpha-globulin range.

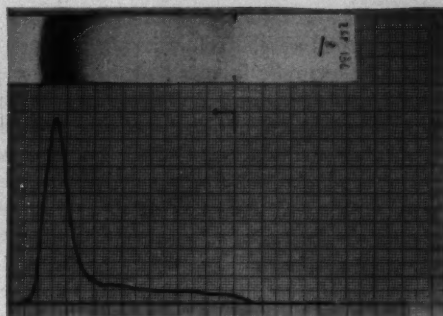


Fig. 3 (Orzalesi and Miglior). Electrophoresis of supernatant fluid detects only an alpha-crystalline mobility pattern.

by its own electro-negative charges. The slightly turbid residuum (insoluble heparin-protamine complex) confirms the fact that heparin does effectively substitute for the lens protein in the complex.

These studies, which were carried out on lenses of several species of animals, gave identical results during early life but showed

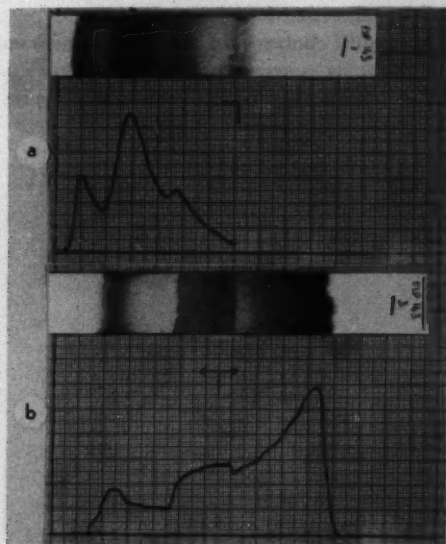


Fig. 4 (Orzalesi and Miglior). Electrophoretic patterns of normal aged lens extract (A) before and (B) after protamine treatment. Arrows show direction of run from point of deposition: toward left, lens proteins; toward right, protamine excess.

substantial differences related to aging. These results were as follows:

1. If protamine is added to the total extracts of lenses from older individuals, there is no longer precipitation of alpha-crystalline alone, but some of the slower fraction is also precipitated out (fig. 4). The older the lenses from which the extract is taken the greater the amount of precipitation of the slower fractions and less distinct is the electrophoretic pattern.

2. The action of the serum protaminase in splitting off the alpha-crystalline from the protamine-lens protein complex was gradually diminished in the extracts from older lenses and ultimately was ineffective (fig. 5). In some species this effect was noted in younger lenses than in others and this effect was often noted in lenses taken from persons who had barely reached adulthood. This effect was noted whether or not the lens extract produced satisfactory separation of the components and was particularly noticeable in horses even up to a very old age (François et al.,² Orzalesi and Miglier¹¹).

3. On the contrary the action of heparin on the complex remained unchanged regardless of lens age and loss of the electrophoretic individuality of the various fractions.

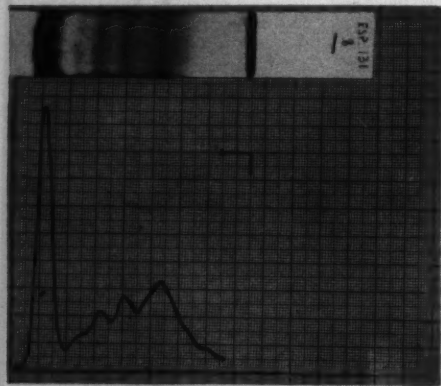


Fig. 5 (Orzalesi and Miglier). Reaction of serum protaminase on protamine-alpha crystalline complex is diminished in extracts from older lenses: the electrophoretic pattern does not show an increased serum alpha-globulin range.

Electrophoretic examination of the mixture, obtained by the heparin clearing action on the precipitate, allows one to detect all of the aliquot first subtracted from the extract, that is, the one also precipitated, by protamine, from the intermediate fraction (fig. 6). Therefore, the pattern of the aliquot, unprecipitated by protamine, can be considered a complement of the heparin-removed fraction.

On the basis of these preliminary observations, it is not possible, as yet, to formulate definite conclusions.

Three hypotheses are advanced to explain that throughout life coprecipitation with basic proteins also affects some of the electrophoretically slowest fractions of the lens proteins:

1. Aging of lens would produce new reactions among molecules of the several soluble proteins, which for gradually increasing amounts of alpha-crystalline may combine with the slowest fractions by unknown links; therefore alpha crystalline² has a slower pattern.

Such a possibility has already been suggested by Dische¹² in a discussion of a communication by François in which the latter author attempted to explain the presence of

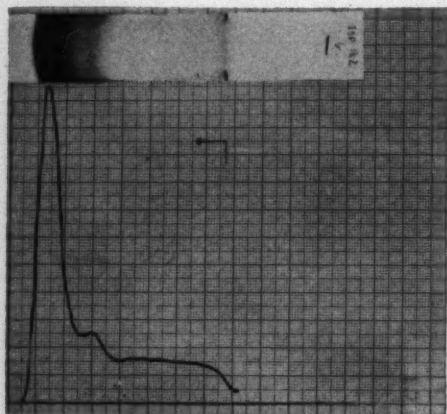


Fig. 6 (Orzalesi and Miglier). Electrophoresis of supernatant fluid detects an alpha and beta crystalline mobility pattern.

small amounts of the intermediate fractions which had been detected by agar-ultramicro-electrophoresis. According to Dische, these intermediate fractions could be due to a link between the alpha and beta crystalline. These associations or links may so influence the mobility of the proteins that a protein of intermediate mobility might result.

Wieme and Rabaey⁷ have suggested that there may occur throughout life a polymerization of the alpha-crystalline molecules which would be more marked as one approached the nucleus from the lens cortex. These authors have also observed that the oldest alpha-crystalline (located in the lens nucleus) contains molecules which behave as larger molecules upon ultracentrifugation.

These modifications, like the preceding, lead to the same results, that is, a slower migration of the alpha-crystalline electrophoretic pattern and then to its dispersion throughout the electrophoretic pattern. By this manner it could be explained why the protamine precipitant effect also involves the second and third protein fractions. Thus, the decreased specific affinity for alpha-crystalline, so evident in young individuals, is apparent only because the precipitated protein is really always alpha-crystalline.

This first hypothesis is based upon the assumption that throughout life there is a gradual increase in the alpha-crystalline; which hypothesis may not be tenable.

2. According to the second hypothesis, the ability to co-precipitate with basic proteins should involve the other fractions of the lens proteins—second (beta-crystalline) and third fraction regardless of their molecular electric charge. This seems to be borne out by electrophoretic patterns which show a disappearance of the patterns of the slower fractions but spare some of the beta-crystalline patterns. If this were true, there should be interaction between basic proteins and proteins of the lens other than alpha-crystalline. These other fractions should be able to form a complex with protamine without changing their own electrostatic patterns.

3. Finally, a third hypothesis can be proposed, suggesting that the differences that occur throughout life in the protamine reaction may indicate that the aging process leads to the formation of a new lens protein, intermediate in its electrophoretic pattern and susceptible to co-precipitation with basic proteins.

The different behavior of insoluble protamine-lens proteins complex against heparin and serum action and the possibility of breaking the complex by heparin, the action of which is to be regarded as purely electrostatic in nature, seem to be proof for a similar nature of the complex itself, in every case, both when protamine involves alpha-crystalline alone (in young age) and when it involves also the slower fractions (in old age).

On the other hand the complex is getting more and more resistant to serum enzymatic action throughout life, not only as far as the fastest fraction is concerned, but the whole precipitated aliquot; this fact suggests that coprecipitation links between protamine and aged lens proteins are different from those between protamine and young lens alpha-crystalline. As a consequence, groups of the basic protein molecule essential to the enzymatic action are involved in the complex, hence no enzymatic action can occur. Such an hypothetical difference of links obviously cannot depend upon anything but a difference inherent in the lens protein.

SUMMARY

Insoluble molecular complexes have been obtained by the addition of electro-positive proteins to protein extracts from young and aged human and animal lenses. These insoluble complexes were then subjected to the enzymatic action of serum and the electrostatic action induced by the addition of heparin. It has been found that:

1. In early life the basic proteins react specifically with the alpha-crystalline fraction, whereas in later life the co-precipitation reactions involve the other lens proteins to a greater degree.

2. The insoluble complexes obtained from the extract of young lenses may be broken down by the enzymatic action of serum. In older lenses this action is progressively diminished and is gradually lost.

3. These same insoluble complexes may

be broken down by the electrostatic action of heparin, and this reaction persists in spite of the age of the lens. The relationship of these changes to the changes occurring in the lens with age are discussed.

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OPHTHALMIC MINIATURE

The day on which I noticed for the first time my myopia is engraved deeply in my memory. I cannot say how old I was. My father was headmaster of a boarding school, and in the grounds of our house there was a long avenue of old linden trees which formed a shady roof with their intermingling branches. There I used to play sometimes with my friends, sometimes alone. One day I happened playfully to take the glasses off my father's nose and put them on my own, as children will do.

This was 50 years ago. I can still remember the sensation which I experienced. I uttered a cry of wonderment and joy. To this day I had never seen the vault of leafage which towered over my head but as a green tent through which the daylight could not pass. Suddenly I saw, oh surprise! oh stupefaction! oh enchantment!—that in this dome there were luminous holes, that it consisted of distinct leaves, that the sunlight filtered through them and played on them in different shades of green! What surprised me most, what threw me into an excess of ravishment of which I still speak with emotion, was that through certain holes in the foliage I noticed small spots of sky which were quite blue. I clapped my hands and was in an ecstasy.

Francisque Sarcey,
Gare à vos yeux!
Paris, 1884.

NOTES, CASES, INSTRUMENTS

UNLISTED NERVE BRANCHES

OF THE MAXILLARY DIVISION OF THE
TRIGEMINAL NERVE (FIFTH CRANIAL)
WHICH ARE RELATED TO NERVE
ASSOCIATION OF THE LACRIMAL
AND SALIVARY SYSTEMS

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Two unlisted branches of the maxillary division of trigeminal (cranial) nerve are given off in the middle cranial fossa, passing out through superior orbital fissure. These branches were called to the attention of the American Association of Anatomists, at a meeting at Brown University in 1952.¹

The importance of these branches is evident, as secretion of the lacrimal gland depends upon nerve relations. It is stated² that the lacrimal nerve passes "along the upper border of the rectus lateralis to the lacrimal gland. . . . On the lateral wall of the orbit it receives a small branch from the zygomatic nerve (the orbital branch of the maxillary nerve). . . . This branch brings to the lacrimal nerve secretory fibers for the lacrimal gland." Morris-Schaeffer² (page 1092) names branches of the maxillary nerve in the middle fossa of the cranium but "gives them as supplying the dura mater and reinforcing the sympathetic plexus on the middle meningeal artery but no mention is noted here of the branches which pass medially and leave by the superior orbital fissure (described infra).

The lacrimal gland is, in structure like a salivary gland (resembles the parotid gland, Cunningham³) and is generally a serous structure (Piersol-Huber⁴).

The importance of all related nerves to this system of serous secretion (salivary and lacrimal) is evident. Further, since some of the listed nerves are occasionally absent, the variations of all related association nerve tracts become of primary importance. The

lacrimal nerve, or the zygomatic branch of the maxillary division, either (or both) may be default (Piersol-Huber⁴); the lacrimal occasionally seems to be derived from the trochlear (fourth cranial) and considerable variation is found in connection with the zygomatic-temporal branch of the zygomatic nerve. The lacrimal nerve or the zygomatic-temporal branch of the zygomatic may be absent, the place of either being taken by the other, or the lacrimal may be small at its origin and later increase to normal size by accessions from the zygomatic-temporal branch of the zygomatic nerve (the so-called "orbital" nerve, of some texts).

This fact is herein amplified by the description of the two unlisted branches of the maxillary nerve which in part join the lacrimal, in part join the sixth cranial, and in part join the nerve of the pterygoid canal, reaching the sphenopalatine ganglion, and thence distributing to the various areas, including the nasal meatuses. Fractures of the skull-base, or dural inflammations, may involve any of these nerve association tracts.

In addition, the sixth cranial nerve may be absent on one side (Piersol-Huber⁵), the lateral rectus being then supplied by the oculomotor. Here, we note that some texts state that the lacrimal nerve is assisted by the sixth cranial. This would be a further complication were it not that the two unlisted branches noted in this paper supply a direct source to both the sixth cranial and to the lacrimal, as well as to the zygomatic-temporal nerve area.

The sixth cranial nerve, while in the cavernous sinus, supplies filaments to the lateral wall of the sinus, which communicate with the filaments there from the fourth and from the third cranial nerves. (Not noted in usual texts.) These branches are, apparently, fairly constant. I have not failed to find them, if I was careful in removing the overlying dura. The dura must be slit

over the maxillary nerve in situ, and the medial portion carefully lifted toward the cavernous sinus side or the dura will tear loose the two unlisted branches which one desires to view.

These branches pass toward the medial end of the superior orbital fissure which here has a slightly rounded extremity, as if to form a foramen (which, however, is never completely closed off). The branches descend and join the nerve branch descending from the sixth cranial nerve (Am. J. Ophth.⁶). The unlisted nerve branches send communications upward to the lacrimal nerve and downward to the nerve of the pterygoid

canal. Dissection is difficult and dura must be lifted from bone, and bone cut away to permit a view.

CONCLUSION

The unlisted branches of the maxillary division of the trigeminal are of primary importance to the lacrimal nerve supplies and the general salivary system. Reflexes from mouth, nose, and elsewhere are here explained as is the general anatomy of the nerves, including their central connections and relation to the sympathetic and parasympathetic tracts.

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ELECTRO-KERATOTOME*

FOR THE DISSECTION OF LAMELLAR GRAFTS

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The first step in lamellar keratoplasty is to dissect from the recipient eye the external layers of opaque, diseased tissue which are to be replaced by a transparent graft. The area to be removed, whether it consists of part of the cornea or of its entire surface, is first limited with the trephine or some other instrument. The pathologic tissue is then dissected out with forceps or dissectors of different type suitable for the purpose. If the keratoplasty is done for optical purposes, the

remaining tissue which is to be the bed of the corneal graft must be as clear as possible; therefore nontransparent cornea must be completely dissected, sometimes close to Descemet's membrane or even down to the membrane. Because the tissue, which may be removed in one or several layers, is always discarded, it does not matter how much it is traumatized by a combination of forceps, stitches, or dissectors.

In dissecting the graft, however, if results are to be optimal trauma must be minimal and the graft dissected as cleanly as possible. Up to the present, the lamellar graft has been dissected from the donor eye in the same manner as the unhealthy tissue was dissected from the recipient eye; that is, by means of a combination of forceps and dissectors and other devices. Not infrequently this method resulted in grafts with some parts thicker than others, a defect which was particularly likely to occur on the inner surface. The method also resulted in more or less injury to the graft, depending on the skill of the

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surgeon and his selection of instruments, such as delicate enough forceps and sharp dissectors. The larger the graft, the more difficult it was to obtain minimally traumatized grafts of even thickness by these older methods.

Several semiautomatic instruments have been designed for dissecting lamellar grafts, but so far none has made it possible to standardize the dissection in such a way that the less skilled surgeon could obtain grafts as perfect as those made by the more skilled men. When the Brown electric dermatome for dissecting cutaneous grafts first appeared, I felt that a similar instrument might advantageously be used in dissecting lamellar grafts, and I actually used the Brown instrument in two cases. But the instrument proved so bulky that it was difficult to observe the donor eye, especially close to the cutting blade; for this reason it was difficult to place the dermatome accurately at the edge of the graft. Moreover, the mechanism for measuring the thickness of the graft was not accurate enough for keratoplasty, and it seemed likely that a simpler mechanism could be devised which would be more practical for this purpose.

Following my specifications, the Storz Instrument Company has made an instrument called the electro-keratotome, which is devised especially for cutting lamellar grafts of any size and any thickness permitted by the donor cornea. The instrument consists of two main parts: The first is the head (fig. 1), which contains the blade carrier and the gauging mechanism for determining the

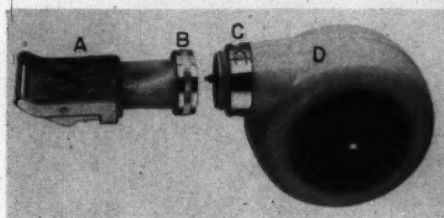


Fig. 1 (Castroviejo). Electro-keratotome. (A) Head of the electro-keratotome. (B) Rotary motor which supplies the power to the head.

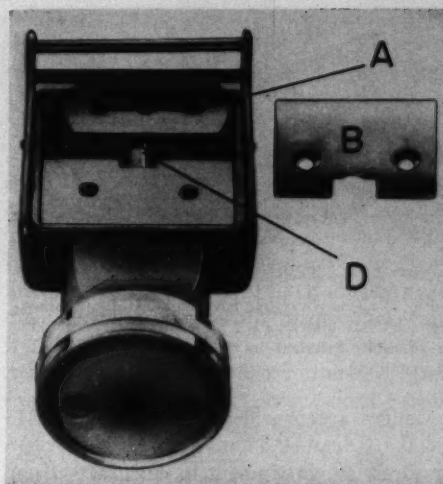


Fig. 2 (Castroviejo). Electro-keratotome, showing disposable double-edge razor blade, (B) plate which covers the blade, and (D) eccentric disk which through the power of the motor actuates the blade.

thickness of the graft (fig. 1-A). The second is the electric motor which supplies the power to the head (fig. 1-D). This motor is a rotary type such as is used for electric razors and runs on alternating or direct current of 110 to 220 volts. The head is attached to the motor at Figure 1-C by means of the ring (B). The small disposable, double-edged razor blade (fig. 2-A) is attached by the plate B to the head by means of two screws (fig. 3-C). The blade is actuated by an eccentric disk (fig. 3-D), which is connected by a shaft to the electric motor and oscillates one-sixteenth of an inch on each revolution of the disk.

The distance between the bar guard (fig. 4-C) and the cutting blade on the head (fig. 4-B) determines the thickness of the graft. This distance is adjusted by placing a thickness gauge (fig. 4-D) between the guard and the body of the instrument carrying the blade. The front guard is pivoted so that it can be raised, opening the gauge holder at the rear so that gauges of the desired thickness can be inserted.

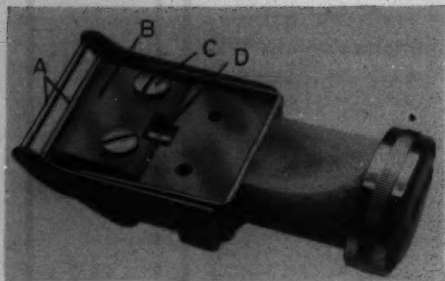


Fig. 3 (Castroviejo). Electro-keratotome, showing (A) bar guards (B) plate-holding razor blade in position, fastened by thumb screws (C). (D) Eccentric disk.

Gauges are provided in thickness of 0.1, 0.2, 0.3, 0.4, and 0.5 mm. so that it is possible to adjust the instrument to cut grafts from 0.1 to 1.5 mm. thick. The average thickness of a lamellar graft is 0.5 mm. but, if the recipient eye has been dissected deeper than this, the thickness of the graft is increased to compensate fully for the additional depth. When the thickness gauge is in place, the gauge holder (fig. 4-F) is locked in position by means of a thumb screw (fig. 4-E) and the distance between the bar guard (fig. 4-C)

This instrument is manufactured by Storz Instrument Co., 4570 Audubon Avenue, St. Louis 10, Missouri.

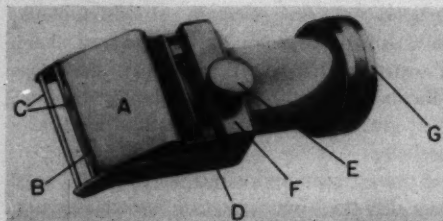


Fig. 4 (Castroviejo). Electro-keratotome, showing (A) blade holder, (B) razor blade, (C) bar guards, (D) gauge, (E) thumb screw to fasten gauge holder (F). (G) Ring to connect the electro-keratotome to the rotary motor.

and the blade (fig. 4-B) is identical with the thickness of the desired graft. The instrument is then ready for use, and even the less able surgeon can automatically cut lamellar grafts of exactly the correct thickness. The head of the instrument is of stainless steel to prevent corrosion.

The electro-keratotome is used only for the donor eye. First, a groove is cut with a trephine 0.1 mm. deeper than the desired thickness of the graft (fig. 5-A). The head of the instrument is then applied as illustrated in Figure 5-B, with the two bar guards pressing against the cornea, which flattens ahead of the blade (fig. 6). The surgeon then moves the instrument gently forward, pressing lightly against the eye;

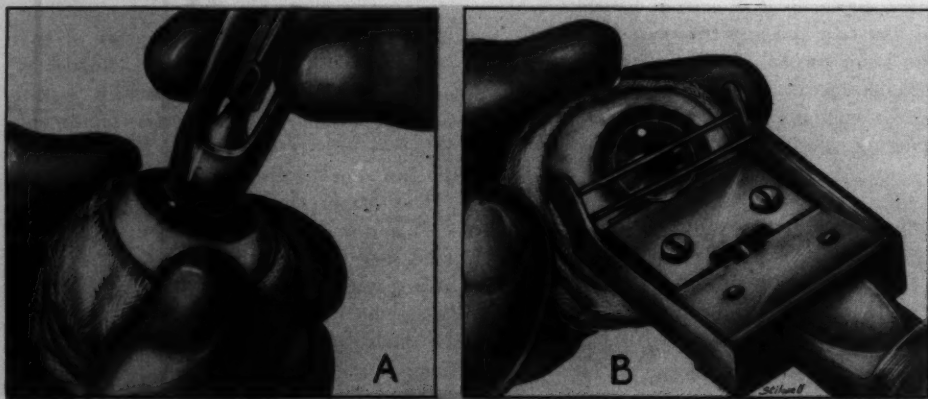


Fig. 5 (Castroviejo). (A) Trephine set to cut 0.1 mm. deeper than the thickness of the lamellar graft, outlining the graft in the eye of the donor. (B) Electro-keratotome dissecting the lamellar graft.

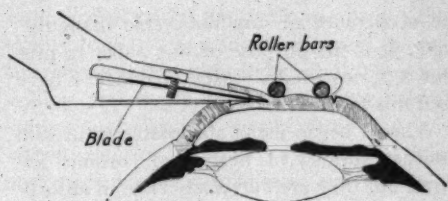


FIG. 6 (Castroviejo) (A) Detail cross section of the electro-keratotome, showing the bar guards pressing and flattening the cornea ahead of the cutting blade.

the lamellar graft should be automatically dissected with little effort and with minimal trauma to the graft. With this instrument two grafts of 6.0 mm. each in diameter have been removed from a single donor eye, and grafts of even thickness 11.0 and 11.5 mm. in diameter have been cut.

Although the electro-keratotome was originally designed for the dissection of the lamellar grafts, it has also proved useful for cutting buccal mucous grafts. Since these buccal grafts are preferably fairly thin, the instrument is set with a 0.2 mm. thickness

gauge. The area from which the graft is to be taken is infiltrated with the anesthetic with some adrenalin added to minimize bleeding. The lip is then stretched by clamps (fig. 7), or by some other method, and the lip is pressed forward with gauge under the lip to make the mucous membrane taut. By means of the instrument either two grafts may be taken one from each side, as illustrated in (fig. 7-A); or a longer graft can be cut along the lip as in Figure 7-B. I have already used this instrument for plastic repair of cases of symblepharon which necessitated reconstruction of over half the bulbar conjunctiva, and found that I had more buccal material than I needed. The instrument has been successfully used also in three cases of extensive scarring of the conjunctiva following several operations for recurrent pterygium. If additional mucous membrane is needed, it can be taken from the buccal surface of the cheek.

One great advantage of the electro-keratotome over previous instruments used for dissecting buccal material is that it cuts the grafts so thin that they do not need further

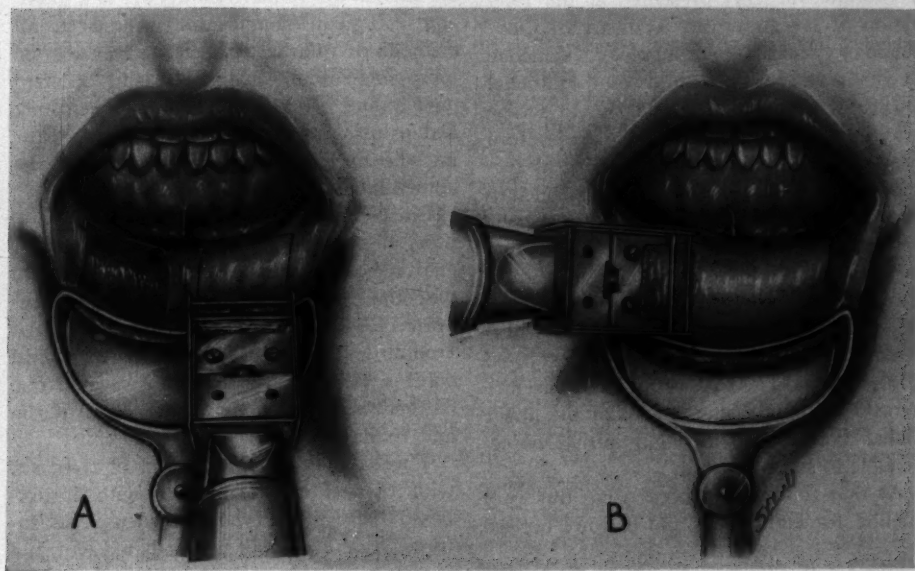


Fig. 7 (Castroviejo). Electro-keratotome dissecting buccal mucous membrane grafts.

thinning. In addition, the buccal area from which the graft has been taken does not require sutures, but is epithelized within a few days. The patient suffers little discomfort, and the lip is left with no trace of the dissection or at least an area of cicatrization which is unnoticeable. The grafts also heal in the recipient eye with very little scar formation and in a few months assume the character of almost normal conjunctiva.

9 East 91st Street (28).

DENUDING THE CORNEA IN CATARACT SURGERY*

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Evidently my idea of denuding the cornea in cataract surgery, that is, removing the epithelium along the edge of the corneal incision in order to prevent epithelial downgrowth has been thought of by others but no one has reported trying it.

In an extensive and detailed symposium on cataract surgery⁷ presented at the 1954 session of the American Academy of Ophthalmology and Otolaryngology, someone asked the question, "to prevent epithelial downgrowth, would it be helpful to scrape away the epithelium at the limbal area before inserting sutures or making a corneal section? A fornix-based flap is recommended to cover this disnuded area." Frederick Davis was asked to reply and he said, "Denuding the epithelium of the cornea at the limbal area of the incision would induce adhesion of the conjunctiva to the cornea if a fornix-based flap were drawn down and sutured firmly over it. The flap would likely produce some permanent disfigurement of the upper limbal border which might prove objectionable to some patients."

At that time, I had been using this very method for eight years and had not noticed

the occurrence of any noticeable disfigurement. It is the purpose of this paper to present a series of 257 cases in which I have used this method.

When I began using absorbable sutures in cataract surgery, I first tried chromic sutures, but they are extremely slow in absorbing and often had to be removed the same as silk sutures. I then tried plain 4-0 catgut and found that, by using the Stallard suture (often called the Liegard or Kalt), I could use this coarse 4-0 plain suture very easily. Before long, however, I had two cases that developed what appeared to be epithelial downgrowth and, for that reason, I considered abandoning this suture.

Apparently others have had unhappy experiences with this suture. Goar¹ says he "once adopted the Stallard suture so the wound could be closed easily," but he discarded it because "a mattress suture may turn the edges of the wound in and this is a prolific source of epithelial downgrowth."

Epithelial invasion of the anterior chamber is not, however, a condition limited to the use of the Stallard suture. It is a grave and malignant complication found in all methods of cataract surgery. It seems to be increasing rather than decreasing in frequency and often is found even when long and painstaking care has been used in closing the operative wound with any of the known methods of corneoscleral sutures.

Pincus² reported five cases in two years' time, all with corneoscleral sutures of various types, one with a fornix-based flap and the other four with no flap. Calhoun³ reported 17 cases in which the technique varied from little or no suture to three corneoscleral sutures. Berliner⁴ reported nine cases. None of them had conjunctival flaps; in all Kirby and Stallard sutures were used.

Theobald and Haas⁵ reported 14 cases, six with corneal incisions, three with fornix-based flaps and Verhoeff corneoscleral sutures. Nine had small limbus-based flaps not covering the wound at the sides. Both Berliner and Theobald and Haas recommend a

*Read at the annual meeting of the Texas State Ophthalmological Society, April 22, 1958.

large limbus-based flap with an apron sufficiently broad so that the base covers the entire edge of the corneal incision. They are willing, apparently, to sacrifice corneoscleral sutures and risk the complications of a collapsed anterior chamber, a prolapsed iris, and more frequent hyphema, and forego a means of quickly closing the corneal wound after delivery of the lens. They risk these complications to avoid the danger of epithelial downgrowth.

I did not wish to abandon corneoscleral sutures so I decided to try something new in an attempt to avoid epithelial invasion. I decided to denude the cornea of epithelium for two or three mm. along the edge of the corneal wound. I commenced by freeing the flap from the limbus then, using a Gill knife, thoroughly denuding the cornea and limbus for about three mm. all along the edge of the wound. I then placed the Stallard suture in the conventional manner, bringing the ends through the fornix-based flap. The incision was made with a von Graefe knife and often enlarged with scissors. The cataract was removed, the flap and corneal incision tied into the Stallard suture, and the remainder of the wound entirely covered by means of two plain 4-0 gut sutures, one on either side biting into the flap and then into the conjunctiva near the limbus.

The results were most gratifying. The conjunctival flap adhered to the raw cornea almost immediately and soon joined its conjunctiva to that of the cornea to make a completely sealed wound. I now have used this technique in 257 cases in my private practice without a single case even appearing to have an epithelial downgrowth.*

After using this technique, I discovered that avoiding epithelial downgrowth was only one of the advantages to be gained from denuding the cornea. There was far less intra-

ocular inflammation. By denuding the cornea and covering the entire incision with a flap, the entire area became at once a well sealed-off wound—almost as well sealed from infection from the outside as is the peritoneal cavity following an abdominal closure. There were no panophthalmitis cases in the series, and only a moderate number of cases of iritis. The anterior chamber usually formed at once. That the wound was well sealed off from the conjunctival secretion was evident from the fact that often an edematous bleb, similar to a filtering trephination bleb, formed beneath the conjunctiva. As healing progressed, this bleb disappeared and the conjunctiva flattened and retracted.

There was a surprisingly low incidence of hyphema (only two in 257 cases). The unusually low incidence of hyphema merits discussion. Hyphema has always been an annoying, dangerous, and, at times, a serious complication of cataract surgery. It is well known that leaving blood in the anterior chamber at the time of surgery does little or no harm. However, later—from three to eight days following surgery—hemorrhage presents a serious problem. Unless the blood is removed or completely dissolved within a few days, glaucoma will follow.

Hughes had hyphema in 20 percent of his series of 453 cases. He did not feel that the type of suture was important. Stallard,⁸ however, thought that the type of suture was very important. He had 30 to 35 percent of hyphema cases before using his suture. After using it, he did 107 cases without a single hemorrhage. Phillips, using the Stallard suture, has reported 120 consecutive cases without a hemorrhage. Peters was not so fortunate. He says, "the freedom from post-operative hemorrhage since adopting this (the Stallard) suture has not been my fortune. I see it with unpleasant frequency in spite of this or any other suture."

Verhoeff,⁹ McLean,¹⁰ Kirby,¹¹ Lehfeld and Donnelly,¹² and Leech and Sugar¹³ say that the incidence of hyphema was reduced by corneoscleral sutures as against no cor-

* Often there will be difficulty differentiating between epithelial downgrowth and fibroblastic ingrowth. Swan⁴ gives an excellent description of these two conditions and clearly defines their differentiating characteristics.

neoscleral sutures. (In each report, the author was describing his own suture.) Devoe reported as many intraocular hemorrhages when using the corneoscleral sutures as when using conjunctival sutures—20 percent of 453 cases.

Vail found hyphema rare in corneal sections, as does Ray K. Daily.¹⁴ Since the Stallard suture is often placed well into the cornea, this may account for the fact that hyphema has been such a rare occurrence in my series of cases. The firm adherence of the conjunctival flap to the cornea may also be significant in preventing hyphema.

After a cataract operation performed as I have described, the wound will leak but not to the surface. It will leak beneath the conjunctiva, forming a bleb. As healing takes place, this bleb disappears. Chandler (1947), Reese (1948), Leahey (1951), and Dunnington (1946) disagree with those who believe that injection of air is sufficient to cure a flat anterior chamber. This puzzles me for usually air injection has worked well in this series. This is perhaps due to the fact that, although there occasionally is sufficient wound leakage in this technique to allow the chamber to remain flat, nevertheless, this leakage is subconjunctival, and, therefore, air will not leak out when injected. Ordinarily, following air injection, the wound will heal spontaneously when given time.

SUMMARY

Denuding the cornea of epithelium for two or three mm. along the line of the corneal incision has been considered by other surgeons as a means of avoiding epithelial downgrowth. However, it was feared that denuding the cornea of epithelium and covering the area with a flap would cause disfigurement along the upper border of the cornea. A series of 257 cases is presented here which shows that this disfigurement does not occur. The wound heals cleanly, and the method has been effective in avoiding epithelization of the anterior chamber. Other advantages of the technique are:

1. The wound is tightly closed and the interior of the eye is sealed from infection from without.
2. No cases of panophthalmitis have occurred, and there has been very little intraocular inflammation.
3. Hyphema occurs very rarely. There were only two cases of hyphema in this series of 257 cases as compared with an average of 20 percent reported by various authors using other methods.
4. The anterior chamber forms rapidly.
5. Cases of collapsed anterior chamber usually are readily repaired with air injection.

Pasadena Professional Building.

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TONOGRAPHY

WITH RESTORATION OF THE INITIAL PRESSURE

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New York

Individual variations of scleral rigidity may induce a considerable error in tonography. If the scleral rigidity deviates from average, P_0 , or the intraocular pressure before the start of the tonography, and the ΔV_s , or the change of scleral volume during tonography, both used in the calculation of the coefficient of outflow, differ from the average values used in routine tonography. In order to avoid this error, the coefficient of rigidity of the examined eye can be determined, and this coefficient can be used for correction of P_0 and ΔV_s by calculation or by a graphic method.¹

Another way to avoid the error is not to correct the values of P_0 and ΔV_s , but to exclude, as far as possible, the influence of scleral rigidity on the determination of the value of P_0 and of the loss of volume of the eye during tonography. This can be done for P_0 by applanation tonometry, and for ΔV_s by constant pressure tonography.

If the pressure in the eye during tonography, P_t , is constant from the beginning to the end of the tonography, no change of scleral volume occurs and the whole change of the volume of the eye, ΔV , is represented by the change of the corneal volume, $V_{c2} - V_{c1}$, which is not influenced by variations of scleral rigidity.

P_t can be kept constant by continuously adding weight to the plunger of the tonometer, so that the pairs of plunger weight and scale reading correspond always to the initial value of P_t .

It is particularly difficult to keep P_t constant.²

The same goal can be achieved in an easy way by restoration of the initial P_t at the end of the tonography. The value of P_t given by weight and scale reading is independent of scleral rigidity. In tonography with final

restoration of the initial P_t , an average P_t , the arithmetic mean of highest and lowest P_t , is active as in the usual tonography. The average P_t of the period of P_t restoration is the same as in the period of P_t drop.

At the moment of initial pressure restored, the scleral volume is equal to the initial scleral volume, and the whole loss of volume or loss of fluid from the eye during tonography is given by the difference of the volumes of corneal indentation at the moment of pressure restoration V_{c2} and at the start of the tonography V_{c1} .

$$\Delta V = V_{c2} - V_{c1};$$

$$C = \frac{\Delta V}{(P_{t_{av}} - P_0 - \Delta P_v)t}$$

t is the time from the starting point of the tonography to the point of pressure restoration.

Practically, the restoration of the initial pressure is done in a very simple way. At the end of the usual tonography, a two-gm. weight (the weight of the Schiötz tonometer marked 7.5) is added, and in quick succession another two-gm. weight. The corresponding scale readings are noted. Thus four points are found; the starting point of the tonography, A; the end-point of the tonography, B; and two points by adding the two two-gm. weights, C and D.

These points are marked in a graph of weights and scale readings (figs. 1 and 2). The straight slightly divergent lines in the graph are lines of constant P_t . Such a P_t line is drawn from the initial point of the tonography, A. Through the three other points a slightly curved line is drawn, the line of pressure rise for restoration of the initial P_t . The point of crossing of the two lines is the point of restored initial P_t . The volumes of corneal indentation are seen in the same graph, and the corneal indentation volume at the point, X, which is V_{c2} , and the corneal indentation volume at the point, A, which is V_{c1} , are read from the graph.

$$\Delta V = V_{c2} - V_{c1}.$$

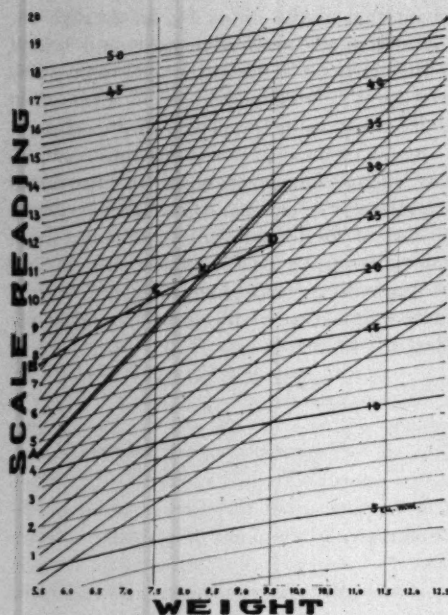


Fig. 1 (Kessler). (A) (weight 5.5 gm., scale reading 4.6) is the starting point of the tonography. (B) (weight 5.5 gm., scale reading 7.7) is the end-point of the tonography. (C) (weight 7.5 gm., scale reading 10.1) and D (weight 9.5 gm., scale reading 11.9) are the points reached by adding the two two-gm. weights. (X) is the crossing point of the P_t line from (A) and the pressure restoration line (BCD). It is the point of restoration of initial P_t ; V_{a1} (22.3 mm.) is the corneal indentation volume at (X); V_{e1} (11.2 mm.) is the corneal indentation volume at (A); $\Delta V = V_{a1} - V_{e1} = 11.1$ mm. (Grant's average ΔV for this tonography is very close, 10.91 mm.)

For better P_t restoration, four one-gm. weights or more smaller weights are added at regular intervals.

The methods which correct the values of P_o and ΔV_s are based on Friedenwald's formula of rigidity and the definition of the coefficient of rigidity given by this formula. The methods which exclude the influence of scleral rigidity on tonography are independent of this basis, and remain valid, if Frie-

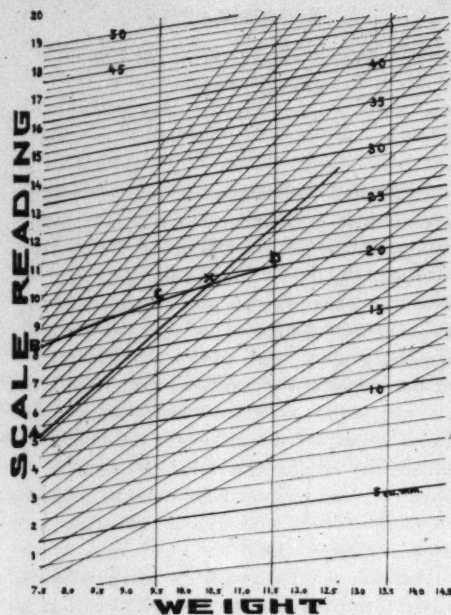


Fig. 2 (Kessler). (A) (weight 7.5 gm., scale reading 5.2); (B) (weight 7.5 gm., scale reading 8.3); (C) (weight 9.5 gm., scale reading 9.9); (D) (weight 11.5 gm., scale reading 11.2). V_{a1} (corneal indentation volume at X) is 19.3 mm.; V_{e1} (corneal indentation volume at A) is 10.4 mm.; $\Delta V = V_{a1} - V_{e1} = 8.9$ mm. (Grant's average ΔV for this tonography is 10.2 mm.)

denwald's formula is not sufficiently adequate to describe the relations of pressures and volumes involved.³ In this case a readjustment of the tables of pressures and volumes will be necessary but the methods of constant pressure tonography and of pressure restoration tonography can be applied to the adjusted tables.

SUMMARY

A method is described to find the loss of fluid from the eye during tonography, avoiding the error induced by deviation from average scleral rigidity.

229 East 79th Street (21).

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OPHTHALMIC RESEARCH

EDITED BY FRANK W. NEWELL, M.D.

Abstracts of papers presented at the meeting of the Western Section of the Association for Research in Ophthalmology, Inc., San Francisco, California, November 17 and 18, 1958.

A. Ray Irvine, Jr., Los Angeles, California
Section Secretary

Retina circulation time with the aid of fundus cinephotography. Milton Flocks, M.D., and John Miller, M.D., Stanford University Medical School, San Francisco, and Peter Chao, M.D., Polyclinic Medical School, New York.

In 1957, Chao and Flocks described a method of determining the retinal circulation time of cats using intracarotid injections of trypan blue, an ophthalmoscope, and a stop-watch. It was determined that the retinal circulation time of the cat retina was approximately two seconds. At that time the authors suggested that if more innocuous indicator solutions could be used, the method could possibly be adapted for use on humans.

When a cobalt blue filter is inserted in the ophthalmoscope the retina appears dark purple in color and the vessels black. When intravenously injected fluorescein reaches the central retinal artery, it lights up the artery to a fluorescent yellow. The fluorescein returning in the vein can be timed just as was the trypan blue. However, the end-point in the returning vein is not as sharp to the observer with the stop-watch as it is using trypan blue. We have devised a method using fundus cinephotography with a cobalt blue filter by means of which the retinal circulation time is precisely determined. The method is objective and no stop-watch is needed. Fundus moving pictures showing the fluorescein moving into the retinal arteries and veins are shown.

With this technique, the retinal circulation time has been found to be faster than previously determined by the stop-watch-trypan blue method. The average circulation time of the cat retina is approximately one and six-tenths seconds. The faster time obtained by this method may be accounted for by the absence of reaction time lost in pressing the stop-watch.

Mechanically induced glaucoma in animals: Preliminary perfusion and histologic studies. Milton Flocks, M.D., Isamu Tsukahara, M.D., and John Miller, M.D., Stanford University Medical School, San Francisco.

• Increased intraocular pressure in one eye of 40 rabbits was produced by the use of a tight encircling rubber band sewn to the sclera around the equator of the eye in the manner of a Schepens' encircling tube. Whereas the intraocular pressure readjusts itself following the application of a too-tight Schepens tube, such readjustment does not readily occur when a rubber band is used because, as the eye gets smaller, the

rubber band also contracts and continues to apply external pressure.

The tension, initially high, usually gradually decreases. The period of elevated tension ranged from three to 34 days with an average elevation of 14 days. The anterior chamber remains deep and the peripheral cornea becomes vascularized. Both eyes of 20 of the rabbits were removed from two to five weeks after the experiment was begun. The remaining rabbits are being kept alive for study. The rubber bands were then removed from the enucleated eyes.

In 11 rabbits both eyes were simultaneously perfused. In every rabbit there was a marked decrease in facility of outflow in the operated eye.

Histologic examination reveals cupping of the discs, optic atrophy, degenerative changes in the retina and vascularization of the cornea—the histologic picture of glaucoma. The rabbit filtration angle is so different than the human that at this time it is difficult to be sure from a histologic standpoint that damage to the meshwork is present. In only one case were definite anterior synechias present.

Corneal responses to repeated inoculation with herpes simplex virus in rabbits. M. Okumoto, M.A., E. Jawetz, M.D., and M. Sonne, A.B., the Francis I. Proctor Foundation and the Department of Microbiology, University of California, Medical Center, San Francisco.

The question of immunity to herpes simplex is of special interest to the ophthalmologist since a herpetic infection in the cornea usually leads to repeated recurrences with impairment or loss of vision.

Investigations by a number of the early workers have shown that the rabbit cornea is immune to infection by the herpes simplex virus after a single infection. More recent reports have indicated that the degree of immunity is very variable. All previous studies, however, employed a single challenge inoculation following the immunizing inoculation. Therefore, it was felt that a study of this problem using repeated inoculations with different strains of this virus would be of interest. Three strains of the herpes virus were used. The role of the circulating antibody in herpetic keratitis was also checked by taking serum samples at appropriate times and testing for neutralizing antibody levels.

Rabbits were given five consecutive corneal inoculations approximately a month apart. The

first two inoculations were given with the Peterson strain and the third and fourth with the H51 strain. The fifth inoculation was with the HF strain. The results from these inoculations showed marked protection to the second inoculation with the Peterson strain, but no significant protection when a different strain, the H51 was used. The second H51 inoculation, however, resulted in very few corneal lesions as did the last inoculation with a third strain, the HF. There was also a lack of correlation between the circulating antibody level and the extent of immunity to herpetic infection in the cornea. Because the results suggested that the resistance of the rabbit cornea to herpes simplex virus is strain specific, a cross neutralization test was performed in mice using antisera to strains H51 and Peterson. The findings indicate that a slight but definite strain difference exists.

Histogenesis of retinal tumors. S. Ry Andersen, M.D., Copenhagen, Denmark. From the Francis I. Proctor Foundation for Research in Ophthalmology, University of California School of Medicine, San Francisco. This investigation was supported by Lederle Cyanamid Company, Pearl River, New York.

An attempt is made to classify the retinal, ciliary epithelium, and iris epithelium tumors on a developmental histogenetic basis relating to the normal stages in human retinal development. The material used is from the Proctor Foundation, University of California, the Ophthalmic Pathology Club, and the Eye Pathology Laboratory, Copenhagen, Denmark. The brain tumors used are from the Langley-Porter Clinic and the sympathicoblastomas from the Department of Pathology of the University of California School of Medicine.

All retinal tumors arise from the primitive medullary epithelium of the brain. Retinoblastomas arise from very undifferentiated medullary cells, the hypothetical "retinoblasts." The only expressions of differentiation are the rosettes, which seemingly imitate the medullary tube.

Medulloepitheliomas of the eye seem to arise at a later stage in retinal development. They usually arise from the inner ciliary epithelium but may develop from the outer epithelium and from iris epithelium. They may arise from the retina. The embryonal form (diktyoma retinae) reflects two stages of normal retinal development: (1) The "embryonal retina" stage (about 10 to 15 mm. fetal length; fifth week), and (2) the more differentiated "epithelial-like" stage which is typically seen in the inner ciliary epithelium after the 60-mm. stage. These two components vary within individual tumors. They may be found in the more dedifferentiated malignant diktyomas, both in the primary tumor as well as in recurrences. Typical diktyomas are mostly unpigmented and form true rosettes. The malignant diktyoma somewhat resembles a retinoblastoma,

but as yet no real transitional forms have been described. Sometimes areas of gliosis and calcification are seen. Abundant mesenchymal vascular stroma and cartilage is seen occasionally. It appears as persistence of primary vitreous localized to the area of tumor formation. Other congenital defects also have been observed in eyes with diktyomas which are hamartomas, that is congenital diseases somewhere between malformation and tumor.

The adult form of medulloepithelioma (epithelioma retinae) arises at a stage when the epithelium is more differentiated.

As a rule pigmented or unpigmented hyperplasias are seen in old blind eyes, imitating ciliary or retinal pigment epithelium and forming cavities.

Localized epitheliomas may appear malignant morphologically, and growth into the orbit and intracranial portion of the optic nerve can occur but, as yet, no metastases have been reported.

From retinal neuroglia the astrocytoma, glioma and oligodendrocytoma may arise.

Leiomyomas of the iris belong histogenetically to the retinal tumors.

Study of these retinal tumors indicates that the differentiation in a given tumor is due to: (1) The embryonal differentiation of the cells from which it originates, and (2) the dedifferentiation of the actual tumor.

A comparison with brain and sympathetic tumors shows some histologic resemblance between the retinoblastomas, medulloepitheliomas of the brain and the sympathicoblastomas, all of which arise from very primitive medullary tissue and sometimes show differentiation into rosettes, seemingly imitating the medullary tube and the embryonal sympathetic tissue. The "embryonal" portions of diktyomas also have a certain resemblance to the medulloepitheliomas of the brain.

Lacrima protein reports in micrograms per minute. Olive F. Erickson, M.D., San Francisco.

At the AMA meeting in June, 1958, we reported a practical laboratory method of showing lysozyme in micrograms per minute. This, we felt, was a simple yet most significant answer in tear proteins, combining the action of lysozyme and the dynamic change of the rate of flow. At that time we reported a group of 50 persons who had no serious eye or systemic problems and found that four percent had less than 1; four percent had 1; eight percent had 2; 16 percent had 3 to 4; 26 percent had 5 to 10; 30 percent had 11 to 30 and 12 percent had more than 30. By using this same technique and the same method of calculating on a more recent group of 50 normal subjects with normal Schirmer tests, we found the average rate in those above the age of 20 years is six, while those below that age are 12 microliters per minute. Those below the age of 19 years had 115 micrograms per minute while the older group

averaged 68. This same proportion carries over into the lysozyme production. The averages for the three major proteins in this group are lysozymes 12, tear globulins 47 and tear albumins 17 micrograms per minute.

Further work on the residual proteins of the vitreous. Anita A. Suran and W. K. McEwen, M.D., University of California Medical Center, San Francisco.

The evidence presented in our previous communication showed the existence of two or more fractions in the residual protein of the secondary vitreous of cattle eyes. The work has been pursued further with additional quantitative analyses.

The method of preparing our starting preparation of residual protein was described.

Two identical samples of isolated residual protein were each subjected to four successive trypsin hydrolyses and washing procedures. One sample was kept wet throughout the experiment while the other was dried to constant weight at each step. Aliquots for chemical analysis were removed from both samples after each enzyme treatment.

Confirming our previous data, the dried material lost significantly more weight than that which was kept wet. However, the composition of both fractions, on the basis of the analytical data, did not differ significantly.

Two explanations may be offered:

1. A single protein which undergoes only surface denaturation upon drying and this denatured material is hydrolyzed by trypsin, or

2. Two proteins, the same chemically or differing within the limits of error of the analytical methods, which show different physical characteristics.

The evidence for differences in physical appearance will be discussed.

Stimulus orientation and threshold, an optical analysis. Frank W. Weymouth, Ph.D., Los Angeles College of Optometry, Los Angeles.

A recent article (Ogilvie and Taylor, 1958) in which the threshold for very fine wires was found to vary strikingly and significantly with the orientation of the wires raises anew an old and puzzling problem. A number of experimenters, including me, using various techniques, have found that linear stimuli are more easily recognized in certain positions, usually vertical and horizontal. A satisfactory explanation for this established fact has proved difficult. Since most workers have taken the precaution to exclude eyes with "clinical" astigmatism, some have felt forced to conclude, rather unhappily, that it is not an optical phenomenon. Other possible causes, such as some sort of "grain" in the retinal organization, are little more attractive.

Have all the optical possibilities, however, been exhausted? This may be doubted. The classical optical picture of a point image for a point source

is not true even for eyes with high acuity and devoid of astigmatism or other defect for which glasses are prescribed. It was shown many years ago by Gullstrand (1924) and reiterated by Lancaster (1943, 1952) that light from points of the object is reassembled in the image not in points but in caustic surfaces of complex form. As intercepted by the retina this refracted pencil is typically an eight pointed "star," the vertical and horizontal rays of which are longer and brighter than the oblique rays while the intensity of all rays is below that of the central portion. This refracted pencil, it should be emphasized, is compatible with a visual acuity of 20/15. Since this deviation from the classical idea of a "focus," does not prevent excellent vision and is noted only in some unusual situation such as stigmatoscopy, it is seldom remembered as a regular feature of refraction. Since the intensity of the rays is far lower than that of the central disc, the nonpunctiform pencil has little effect on a simple object of high contrast such as a Snellen letter. However, as the threshold of a linear object, such as a fine wire, is approached with the contrast at a minimum, the presence of rays may become critical. In such a case the predominantly vertical and horizontal rays add to the contrast of vertical or horizontal wires but reduce the sharpness of the edge gradient when the wire is oblique. The effect is obviously similar to that of "clinical" astigmatism.

It thus seems clear that the "higher order" aberrations of an "emmetropic" or satisfactorily corrected eye may bias the threshold of linear objects for certain orientations.

Cyclodiathermy-dialysis: A tunneling procedure for glaucoma. Ulysses M. Carbajal, M.D., College of Medical Evangelists, Los Angeles.

This paper presents a method for creating a "tunnel" connecting the anterior chamber and the suprachoroida with a combination of cyclodiathermy and cyclodialysis. The ciliary body is separated from the sclera in one quadrant, using the multiple thrust method with some modifications. Before the cyclodialysis is done, a partial penetrating diathermy is applied on each side of the proposed "tunnel" for three purposes: (1) to produce two "pillars" that will prevent the uveal tissue from completely coalescing with the sclera again, (2) to control size of "tunnel" or area of drainage, and (3) to promote hemostasis to a certain degree. In this operation, the incidental destruction of the ciliary epithelium does not significantly influence the intraocular pressure, as the area of diathermy application is far from extensive.

To date, the procedure has been quite effective in controlling ocular tension in 25 patients. Visual acuity, visual fields, and facility of aqueous outflow were improved in the great majority of cases. Gonioscopic examination revealed presence of cleft or "tunnel" in all cases.

The technique is discussed with the aid of Kodachrome slides. The operation is simple and is accompanied by only a few minor complications. The pupil is not disturbed and the ill-effects brought about by filtration blebs are entirely absent.

In all glaucoma patients where other surgeries had utterly failed, even in absolute glaucoma (of course, the presence of an intraocular tumor should always be ruled out) awaiting enucleation, this procedure may be tried. A flattish chamber or marked congestion of the eye is no contraindication. Patients not suitable for iridencleisis and trephining procedures may be operated on.

Experiments in human volunteers with adenovirus type 8. Y. Mitsui, M.D., L. Hanna, M.A., R. Minoda, M.D., S. Ogata, M.D., H. Kurihara, M.D., R. Okamura, M.D., and M. Miura, M.S. Department of Ophthalmology, Kumamoto University Medical School, Kumamoto, Japan, and Department of Microbiology, University of California Medical School, San Francisco.

It is now well established that adenovirus type 8 is the principal and possibly the sole cause of epidemic keratoconjunctivitis. The relationship has been confirmed by numerous isolations of the virus from typical cases, significant antibody response during infection, and serologic epidemiology. One factor remaining to be studied has been the infectivity of adenovirus type 8 for man.

Human volunteers have been inoculated with type 8 virus grown in tissue culture or with scrapings directly from patients' conjunctivas. The typical disease has been produced in those individuals with a type 8 antibody titer of less than 1:20. Volunteers injected subcutaneously with adequate amounts of viable type 8 virus grown in tissue culture have developed neutralizing antibodies with titers reaching approximately the same levels as in individuals with naturally occurring eye infections. These individuals were resistant to ocular "challenge" inoculation with either type 8 virus grown in tissue culture or with infectious material from patients

with fresh epidemic keratoconjunctivitis. However, they remained susceptible to adenovirus type 3, indicating a type-specific immunity. The "vaccine" injected subcutaneously produced no demonstrable clinical illness. Protection was complete only if sufficient amounts of virus were administered to stimulate a specific neutralizing antibody titer of 1:20 or greater.

The results presented support the previous evidence that adenovirus type 8 is the principal agent causing epidemic keratoconjunctivitis, and that laboratory procedures demonstrating type 8 infection now may be used to confirm the clinical diagnosis of epidemic keratoconjunctivitis.

The trabeculae: recent histologic findings. L. K. Garron, M.D., Lynette Feeney, and Joseph S. Goldberg, Oakland, California.

Most of our ideas and opinions as to the microscopic anatomy of trabecular tissue are based on the detailed studies of histologists of 50 years or more ago. Newer techniques of microscopy and histochemistry have added some new information but until the present time our concept of the basic structure of the trabeculae has varied little since the days of Seefelder, Wolfrum and Salzman.

The present study compares thin sections of human trabecular material stained and viewed by phase-microscopy with the findings of electron microscopy. These studies suggest that the scleral meshwork "fibers" do not possess a Descemet-like layer beneath the endothelium nor an elastic tissue layer outside the collagen core. Standard staining techniques for the identification of elastic tissue also stains a nonelastic material outside the collagen core. This material was unknown until recent studies by electron microscopy showed it to be present.

The Descemetlike membrane claimed to be present under the endothelium is not found by our techniques.

Our studies indicate certain differences between the endothelia of the cornea and trabeculae. The variations are sufficient to suggest that they are not similar cell types.

SOCIETY PROCEEDINGS

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DR. HARVEY THORPE, *President*

ROUND TABLE CONFERENCE

Complications of ocular surgery

Discussers: DR. PAUL A. CHANDLER, Boston; DR. WILFRED E. FRY, Philadelphia; DR. SAMUEL J. MEYER, Chicago; and DR. BENJAMIN SACHS, Boston

Moderator: DR. HARVEY THORPE

1. *How soon after cataract surgery is it possible to recognize pupillary block and what are the diagnostic signs and treatment?*

DR. CHANDLER: As to the time when pupillary block develops after cataract extraction I'm not sure. I would guess from two or three weeks on. After an intracapsular extraction it is recognized in two ways: by a shallowing of the anterior chamber in the presence of a normal or an elevated tension, or in the case of round-pupil extraction, the anterior chamber may be normal in depth but the intact hyaloid bulges forward through the pupil and the tension is elevated.

If the condition is not relieved, the hyaloid bulges further and further forward until it touches the cornea and then we see corneal edema. In a case of extracapsular extraction, either planned or unplanned, the recognition of pupillary block is sometimes more difficult but the telltale sign is unevenness in depth of the anterior chamber. There is no reason I know of for the anterior chamber in aphakia to be of different depths in different areas, except pupillary block. This may occur even after intracapsular extraction. Where there has been considerable postoperative inflammation, an inflammatory membrane may fill the pupil. The chamber as a whole may be reasonably normal, but one area may be more shallow than another.

There is one point about pupillary block which is worth emphasizing. The flat chamber which sometimes occurs in the immediate postoperative period in association with a separated choroid is a great predisposer to pupillary block. Pupillary block can occur in eyes that have had a flat chamber and separated choroid, even in cases with full iridectomy. We know that in cases where the chamber is shallow or flat and there is separation of the choroid, the pressure is always very soft. In these cases the chamber may form but remain shallow. We expect that within a day or two the chamber will deepen. But suppose the chamber remains shallow and, as time passes, we note that a separated choroid is no longer present and the tension is no longer very soft. The tension is normal. Now the chamber has not changed in depth. Originally the shallowness was due to the usual causes associated with separation of the choroid but now it is merged into a situation where there is pupillary block.

I believe it is absolutely diagnostic of pupillary block if the anterior chamber is shallow and the tension is normal or elevated since, in cases of a shallow chamber from one of the usual causes, one always finds the tension to be subnormal, under 15 mm. Hg.

There is another kind of block that may occur soon after the operation. The chamber is flat and there is separation of the choroid. Tension is soft. Examination with the slit-lamp reveals that the hyaloid fills the entire pupil and coloboma. As Swan has pointed out, this is a form of pupillary block with soft tension. Sometimes in such cases dilatation of the pupil with neosynephrine and strong mydriatics may cause the chamber to form within 30 minutes.

In congenital cataract surgery, pupillary block is always a great hazard, and this is manifested sometimes by a gross peripheral synechia which extends well out onto clear

cornea. I believe there is no other cause for such gross peripheral synechias than pupillary block.

As for treatment, pupillary block is a purely mechanical thing and no medical treatment will avail for any length of time. The treatment is to make a peripheral opening in the iris either by peripheral iridotomy or by peripheral iridectomy. If it is done early enough, the chamber immediately becomes deep and the glaucoma is relieved. If we have reason to believe that the situation has been present for some time, then we know the angle is probably largely closed by peripheral synechias. In these cases, in addition to the peripheral iridectomy or iridotomy, we need to do a cyclodialysis.

DR. THORPE: Would you say something about your particular technique in performing the peripheral iridotomy or iridectomy with a cyclodialysis?

DR. CHANDLER: If I think that a peripheral iridotomy is enough, I do it with the Haab discission needle. The knife goes through the cornea at the limbus, punctures the iris, goes behind the iris, and almost immediately, one or two mm. from the original puncture in the iris, back into the anterior chamber. Then the blade is pushed forward till almost the whole blade is through this second opening. The blade is then turned toward the cornea, held against the back of the cornea in the periphery. As the knife is slowly withdrawn one succeeds in cutting the iris between these two points. If a cyclodialysis needs to be done, the incision is made three mm. from the limbus and a regular cyclodialysis is done. The iris is pulled out through the same incision with toothed forceps or an iris hook and an iridectomy done. The wound is sewed up in the usual fashion.

DR. FRY: I was interested in Dr. Chandler's statement in regard to the time of occurrence of pupillary block. In a case in which this recently came to my attention, I put the time at exactly two weeks, not knowing whether that was early or late.

DR. MEYER: I think if one takes the time to examine his postoperative cataract pa-

tient with the slitlamp, one will find that the surgery itself leads to posterior synechias, and that large portions of the iris may be bound down to the anterior vitreous. Yet I presume that in most of the cases we operate there is always some area for drainage; otherwise there would be much more pupillary block than actually occurs.

2. In a diabetic patient, if there is persistent bleeding from the iris after iridectomy, either during cataract or glaucoma surgery what is your procedure for handling this complication? If this hemorrhage should persist, or if a new hemorrhage appears in the postoperative period, how do you attempt to control the situation?

DR. FRY: I believe that in a situation like this, the patient requires a careful medical survey before surgery is attempted. The survey should include not only the diabetic status but also the circulatory status: that is, whether there is any hypertensive or arteriosclerotic background.

After evaluating these factors and when an iridectomy for cataract surgery or glaucoma is under way, if a hemorrhage appears in the anterior chamber, the first thing you do is to stop and wait. It has been my experience that in many of these cases the hemorrhage stops if one does wait. It means waiting for a number of minutes, not just one, sometimes four or five. After that length of time it is safe to irrigate the anterior chamber with saline solution: do not leave hemorrhage in the anterior chamber.

Should hemorrhage continue, a drop of 1:1,000 adrenalin may be dropped on the incision or permitted to be drawn into the eye. Neosynephrine may also be used.

Suppose a hemorrhage persists after this procedure. If the hemorrhage isn't great it seems to me that it is perfectly advisable to permit it to remain and be treated as a postoperative hemorrhage. In many cases it absorbs completely. In a hypertensive patient it may be desirable to lower the blood pressure. The quickest way to lower the blood pressure on the operating table would be to take some blood from his vein. This is safer

and quicker than medication to lower the blood pressure.

DR. THORPE: Are there any general measures that you sometimes anticipate for the second eye from the standpoint of the blood clotting time and any measures or medications that you might like to use previous to surgery?

DR. FRY: I think it is quite important to check capillary fragility and use medication if it might be effective. Check prothrombin time and blood clotting time, bleeding time—all of these, I think, are quite important. Give some vitamin K if necessary and carry on any medications required for the control of any hypertension which may complicate the situation.

DR. CHANDLER: If the postoperative hemorrhage is not massive and the tension is not elevated, I think one of the most effective treatments is to send the patient home from the hospital, so that you don't have to look at him every day.

DR. SACHS: I am reminded of a case where a very hypertensive patient developed severe hemorrhage during operation. It took a long time for the blood to absorb. Subsequently, when the second eye was done, Adrenosem was given intramuscularly half an hour before operation and no bleeding occurred. In addition, at the suggestion of a colleague this patient was given Adrenosem orally every day during his stay at the hospital. He had no bleeding at all the second time. I wonder if there is any value to the therapy or if it was only coincidence.

It was the custom of Dr. Parker Heath to use cold saline solution instead of warm to irrigate the anterior chamber in case of bleeding. He thought that this does help to arrest hemorrhage.

In the case of very hypertensive patients we have not used phlebotomy to lower the blood pressure before surgery. Although there is a lowering of blood pressure immediately after phlebotomy, there is a somewhat later secondary rise in blood pressure which may be just as harmful as the initial hypertension.

DR. MEYER: I have nothing to offer on the

medical treatment of these patients, but I use a somewhat different procedure during operation. I seldom irrigate the anterior chamber with saline; I try to keep as much as possible out of the anterior chamber. I use forceps in trying to do the intracapsular operation and I push the blood aside with the forceps enough to grasp the capsule of the lens, and I'm usually fortunate in the result. In most cases the blood in the chamber absorbs without difficulty. If you have a marked hypertensive patient or one with diabetes and hypertension, you may not always be successful. I was brought up to believe that any patient with blood pressure over 175 mm. Hg systolic should be bled just before operation. We tried this in private surgery but are not sure that it works.

Occasionally one can operate on an individual with exceedingly high blood pressure and get a good result. I operated on one woman with a blood pressure of 260/130 mm. Hg, contrary to the advice of her own physician, as well as mine. She was also highly myopic. The result was excellent, without complication.

DR. THORPE: I generally irrigate the anterior chamber with cool saline solution during the course of the hemorrhage rather than after the clot has formed. I had a curious experience with Adrenasin. A few years ago when I was away on an extended journey, Adrenasin was used for one patient by one of my associates. The nurse evidently thought that this was to be routine procedure from then on. On my return I found we had an unusual number of postoperative hemorrhages. We checked into the pre- and post-operative treatment, and found that all these patients had received Adrenasin. We have, of course, discontinued it since then.

3. Which filtering operation lends itself to the fewest postoperative complications and what are your reasons for this conclusion?

DR. MEYER: The iridencleisis operation. There is a much greater tolerance for technical error in iridencleisis than in a trephining operation, especially if the anterior chamber is quite shallow. In performing an iriden-

cleisis with good surgical technique, usually no instrument has to be inserted into the anterior chamber, in contrast to a trephination in which the trephine blade may enter the anterior chamber and injure the lens and ciliary body. Certainly there is less likelihood of lens injury, as the iridencleisis ab externo incision is usually placed 1.5 mm. above the limbus, while a properly placed trephine opening usually extends a mm. or so over the cornea. If the lens has been displaced forward, this would place part of the trephine incision directly over the upper periphery, thereby increasing the possibility of injury.

There is, however, the greater danger of failure of the anterior chamber to refill after iridencleisis surgery. Although many chambers remain relatively shallow postoperatively, the filtration still seems to function successfully in a large number of cases. The chance of hypotony developing is much less than after trephination, as the resultant blebs are usually flatter.

Late infections are definitely rarer after iridencleisis surgery. The chance of normalizing tension after trephination is probably somewhat greater than after iridencleisis. However, the advantage of greater tension reduction with trephination is offset by the greater incidence of infection. Late infection, though less serious today because of antibiotic therapy, is still of considerable importance.

The incarcerated iris pillars may prevent the lens from coming too far forward. After trephination, the lens may remain displaced forward in contact with the cornea, resulting in the development of malignant glaucoma.

Iridencleisis is the easiest filtering operation for the average ophthalmic surgeon to perform, and tends to be preferred by the ophthalmologist who operates infrequently. Sympathetic ophthalmia results more rarely than after trephination. Iridencleisis is probably preferable in the age group under 65 years.

DR. THORPE: Do you believe there is any place in glaucoma surgery for the use of an artificial seton, a plastic or metallic wedge placed in the wound to maintain drainage,

such as is being advocated by some?

DR. MEYER: While the idea is good, my experience has been that the end-results are poor. Years ago an associate incarcerated some conjunctiva in the wound in a number of cases, and they all turned out poorly. Some years ago we ran a series of cases using magnesium wire, and these also were unsuccessful.

4. What is the pathogenesis of glaucoma occurring after traumatic dislocation of the lens, and what is the treatment?

DR. SACHS: I am glad this question was asked because at present I have a patient with exactly this problem. He is 30 years of age, and in August, 1957, while using a grinder he was struck in the left eye with terrific force by a broken piece of the grinding stone. The initial findings were severe edema and ecchymosis of the lids, abrasion of the cornea, deep anterior chamber with blood in it, dilated immobile pupil, and blood in the vitreous. Vision was limited to the perception of light. There was no evidence of perforation. X-ray studies of the globe showed no fracture or foreign body. He was placed on cortisone therapy. Blood in the anterior chamber absorbed, as did the blood in the vitreous. The lens was totally dislocated into the vitreous, lying in the lower part, apparently still held suspended by the lower zonule. The optic disc appeared normal. Tension felt normal to palpation. No miotic or mydriatic, only cortisone, was given. There was no pupillary block. The chamber remained deep. Free vitreous shreds were apparent in the anterior chamber. The tension rose to 60 mm. Hg and never returned to normal. Miotics and Diamox were given. I saw the patient a few days ago, and the tension was in the middle thirties. An interesting thing is that the lens has remained clear. It is dislocated to the same degree and remains in the same position as immediately after the injury. The optic nerve appears to be normal. Vision is 20/20 with correction.

How does glaucoma occur after a dislocated lens? A lens dislocated anteriorly, partially or totally, into the anterior chamber will

always lead to glaucoma, due to pupillary block. A partial or total dislocation of the lens posteriorly into the vitreous may lead to glaucoma by contact with the ciliary processes. Vitreous in the anterior chamber may block the angle and cause glaucoma. Iritis may occur and be complicated by secondary glaucoma.

In discussing this case with some colleagues in Boston, I received many suggestions as to management. Many thought the lens should be removed to save the eye. I have not been able to bring myself to do that. First of all I know that the eye has free vitreous in the anterior chamber and, as soon as the corneal section is made, vitreous will escape. Some have advised iridectomy above and others round-pupil extraction with small iridotomies. Those that advise extraction feel that the presence of the lens will bring a great deal of trouble. A review of the literature shows that many cases get along for 15 or 20 years or more with the lens remaining clear, and in some the lens becomes opaque and yet the eyes do very well. Seven months have elapsed since the injury, and vision with correction remains normal. A contact lens will be used later.

I am reminded of a very sad situation. Some time ago I was urgently called to the operating room by a colleague. He told me that he was in trouble. He was in the midst of operating on a friend, a one-eyed man who was highly myopic. He had just made the corneal section and fluid vitreous escaped. The eye was collapsed. He tried to take the lens out with a forceps but lost it. It sank back into the vitreous and could not be seen. I did not think quickly enough; I told him to close the wound and return him to his room. Two days later we both saw the patient and found the lens back behind the iris in the pupillary area. With great difficulty we removed the lens extracapsularly. I saw the patient later. He had a totally cloudy cornea with great vascularization and the eye was blind. The thought of that disaster has made me more convinced to leave the dislocated lens alone in my present case.

DR. CHANDLER: I was not one of Dr.

Sachs' colleagues who advised removing the lens. If he had asked me I would have said leave it alone, because, as he pointed out, many of those lenses, unless they become hypermature and cause lens reaction, can stay in the vitreous for many years without causing any trouble.

What is the cause of the glaucoma when the lens is dislocated or subluxated? If it is subluxated we may have a closure of the angle on one side where the lens is tilted forward and then we can understand the glaucoma. But what should we do about it? I would be inclined to treat that glaucoma medically. If the angle is closed by the tilting forward of the lens on one side, by the time we get around to removing the lens if we decide to do so, the anterior synechia will probably be permanent and we will not open that angle by removing the lens. Therefore I would be inclined to treat such a patient medically, or even do a filtering operation if necessary, and leave the lens in place.

We sometimes see a posterior dislocation from injury in which the angle remains wide and open. In some of those patients the glaucoma may be fairly severe for a number of weeks but eventually it quiets down and requires no more treatment. Occasionally the glaucoma will persist with a wide-open angle and there is no obvious cause for it. In such a case, if the glaucoma cannot be controlled medically, I would do a cyclodialysis.

I am unable to see how removal of a lens from the vitreous, except in cases of hypermature cataract and lens-induced uveitis and glaucoma, will improve the glaucoma situation, although years ago it was thought to be the thing to do. I can't recall any cases in which the glaucoma was relieved thereby. So far as I am concerned, I would be inclined to treat the glaucoma medically and leave the lens in place.

DR. FRY: I would like to mention one thing. Not too long ago a patient appeared in the clinic at the hospital with a most unusual dislocation, one that I had never seen before and which might interest you. On his first appearance at the clinic, he had a coloboma from an iridectomy done a number of years

ago. He had a dislocated lens which was hinged about the midpoint in the pillars of the coloboma. When one looked in the eye, one looked directly on the equator of the lens. The lens was extracted. I thought there might be some problem in the extraction; however, the operation was without complications.

DR. MEYER: I agree with Dr. Chandler that it is probably best to leave alone the lenses that are entirely dislocated and, if the eye does develop uncontrollable glaucoma, a cyclodialysis may normalize the tension. In our office we have about five or six cases where the lens is entirely subluxated but was not removed. Two of the patients had cyclodialysis. I have seen very bad results when surgeons tried to remove a lens from the vitreous.

5. *What are the causes of persistent corneal edema after cataract extraction? Are there any preoperative signs which indicate the possibility of this postoperative complication? What measures may the surgeon take to prevent this occurrence? Please discuss the treatment.*

DR. CHANDLER: All cases may have postoperative edema for a short time after cataract extraction, some more than others, but the condition usually clears up in a few days. What are the circumstances under which it does not clear up? I think there are two conditions which will cause persistent corneal edema—severe corneal dystrophy and pupillary block. We all fear to operate on an eye that has marked corneal dystrophy because of the danger of persistent corneal edema. However, I cannot recall ever seeing a patient with persistent edema that did not have vitreous in contact with the cornea. In an eye with a normal endothelium we all know that loose vitreous in contact with the cornea, where the hyaloid has been ruptured, is usually well tolerated and causes no edema of the cornea. In cases of marked dystrophy, even loose vitreous in contact with the cornea almost invariably results in persistent corneal edema.

Preoperatively, then, we may say that any

patient with severe dystrophy is a good candidate for persistent corneal edema. How can we avoid it? A deep scleral section has been advocated. It is thought that the cornea gets better nutrition that way. I could never see just why the eye should do better with a scleral section and it hasn't appealed to me, although I am willing to go along with the idea. I think that, if we can avoid contact of vitreous with the cornea, our cases with dystrophy will do all right.

How can we avoid it? My practice is as follows: after the extraction, which is done in the regular way, the chamber is filled with air and both eyes are bandaged. The patient is kept on his back three or four days until the air is mostly absorbed. Many eyes do well with this technique.

Suppose, however, that in the postoperative period the edema of the cornea persists, and slitlamp examination reveals that the intact hyaloid or loose vitreous is in contact with the cornea. Suppose one sees an area of corneal edema with vitreous in contact with the cornea. One can be sure that the edema will never clear if vitreous remains in contact with the cornea. Therefore, this is a sort of an emergency. There is no use to employ local treatment. In my experience the eye is gone, so far as useful vision is concerned, unless one can get the vitreous away from the cornea. The best way to do that is to do a posterior sclerotomy, press out a large quantity of vitreous posteriorly and then fill the chamber with air.

The edema may sometimes recur. Vitreous will again come in contact with the cornea and the cornea will again become edematous. Then we must repeat the procedure, take out some more vitreous. If that seems radical to you, then think what the eye is going to be like with persistent edema. It is going to be a worthless eye and I believe radical measures are justified to relieve the situation. The point is that once you see vitreous in contact with the cornea, and the cornea is edematous, if you wait a month you can remove vitreous posteriorly and get it away from the cornea but the cornea will never recover. You must act very promptly if you are going to rescue

that cornea. As I said earlier a normal eye with normal endothelium tolerates loose vitreous against its posterior corneal surface very well. But no cornea in my experience will tolerate the intact hyaloid against its posterior surface. We rarely see the intact hyaloid against the posterior surface of the cornea. I think we never see it except in cases where there is a certain amount of pupillary block. We see it in some cases of round-pupil extraction where the hyaloid herniates through the pupil, reaches the cornea, and the cornea becomes edematous. Unless we make an opening in the periphery of the iris and allow the vitreous to go back, the edema is permanent.

Sometimes in the postoperative period, even weeks or months or years after an uncomplicated extraction, perhaps even in cases with a full iridectomy, we note edema of the cornea. We see cases in which the entire area of the coloboma and the pupil is edematous. Slitlamp examination shows that the hyaloid is in contact with the iris all the way around. It leaves the pupil, comes forward, and attaches itself to the cornea. I don't believe this ever occurs except when there is a certain degree of pupillary block. The tension may be normal but one can see posterior synechias all the way around the pupil and the coloboma. Although the block is not complete, it is enough to cause the hyaloid to come forward. Such a situation will never right itself with any form of medical treatment. If surgical treatment is delayed, the cornea will never recover even though we get the hyaloid away from the cornea.

The treatment of an early case would be to do a peripheral iridectomy or iridotomy and inject air into the chamber. If the air did not completely fill the chamber, one would have to make another incision, free the adhesion between hyaloid and cornea with a cyclodialysis spatula, and again fill the chamber with air.

To summarize, loose vitreous is not tolerated against the cornea in cases of dystrophy. In eyes with normal corneas, loose vitreous against the cornea is well tolerated. The intact hyaloid against the cornea is never toler-

ated. The point to be emphasized is that once one recognizes that vitreous contact with the cornea is the cause of the edema, one must not delay the surgical treatment. If the vitreous is removed too late, the corneal changes may be irreversible.

6. If, at the end of a trephining or iridencleisis operation, it is discovered that there is a buttonhole in the conjunctiva directly over the scleral opening, how would you proceed with the operation?

DR. FRY: In my opinion, one way to handle this situation would be: take the buttonhole area and place a 6-0 silk suture on either side of it so as to bring the fold of the conjunctiva together. Then, when you suture your flap down in place, instead of suturing as you would normally, suture it slightly on the bias so that the position of the hole is drawn away from the underlying scleral area. I can't tell you how it works on a fresh case. I do know how it works when a buttonhole has appeared as a late complication. I have seen two such cases.

One occurred in a clinic patient with an iridencleisis who, a number of years later, was hit in the operated eye so that the conjunctiva perforated directly over the area of the operation. He was put in the hospital and watched for a few days—healing was perfect. We did no surgery. With that experience in mind, when I examined a private patient in whom the bleb had ruptured, I thought I knew all about it: all I had to do was put the patient in the hospital and wait till it healed up. However, it didn't heal. In this case I carried out the procedure just outlined. The new flap was elevated and folded in such a way that the opening could be sutured; then the flaps were sutured slightly on the bias so the opening in the trephination and the opening in the conjunctiva no longer were in direct line.

DR. THORPE: Dr. Fry, how would you manage a situation in which there is a limbus-based flap which is buttonholed somewhere near the limbus?

DR. FRY: I think the whole situation can be managed in a somewhat similar way.

Bring the fold of the conjunctiva together so that the opening is closed. A suture is placed on either side of the opening, then the flap sutured back somewhat at an angle so that the area of the buttonhole would be a little bit pulled to the side.

Now, suppose the buttonhole is directly at the limbus. I think one has a much more difficult situation. I would free the conjunctiva from this limbus for a distance of four to six mm., so as to slide the conjunctiva down over the cornea, abrading the corneal epithelium at the time so as to obtain adhesion of the conjunctival and corneal surfaces.

7. Is there any procedure for wound closure during cataract surgery which would tend to prevent postoperative complications? Do the number and type of sutures or suture materials play a role?

DR. MEYER: The use of corneoscleral sutures is a distinct advance in cataract surgery. It accelerates the time of reformation of the chambers of the eye, reduces the time that the patient is required to remain in bed, and permits movement out of bed the first postoperative day. The use of corneoscleral sutures helps greatly in reducing the incidence of complications, especially iris prolapse, hemorrhage, and astigmatism. It also favors wound healing.

Good appositional sutures, neither too deep nor too superficial, coapting the scleral edges of the limbus incision, are much more efficient than conjunctival sutures. Even with a single deep central or vertical suture, inaccurate coaptation of edges may result, and prolapse of the iris may occur on either side. Two, or preferably three, evenly spaced interrupted radial sutures placed in the outer third of the edges of the wound, either before the limbus incision, as McLean has described, or after the limbus incision, are ideal. Occasionally they may be difficult to insert.

Either 6-0 black silk or chromic catgut may be used. The use of catgut, although it is more difficult to handle, is advantageous for both the operator and patient, as it does not have to be removed postoperatively. The use

of more than three corneoscleral sutures may result in a more marked postoperative reaction.

8. Please discuss the management of retinal detachment after intraocular surgery. If the detachment occurs within a month after cataract surgery, how long must one wait before operative intervention?

DR. SACHS: As you know, in Boston most retinal surgery is done by members of the Retinal Service, and possibly 95 percent of retinal surgery consists of sclerectomy with buckles and encircling tubes. It is an operation that takes three to three and a half hours under a general anesthetic, and is quite traumatic even in the best of hands. In the case of detachment complicating cataract extraction, we could not attempt to do the buckling operation any earlier than five or six weeks after the cataract procedure. The reason for not operating sooner is that the wound would certainly open and rupture from the manipulation of the eye.

In the case of retinal detachment complicating glaucoma surgery, the handling would be somewhat different, since the wound is much smaller than after cataract surgery. When retinal separation occurs in the eye with low tension, the tension may be raised by dilating the pupil—even by deliberately giving the patient another attack of glaucoma. In two cases there was spontaneous recovery from the detachment when the intraocular pressure rose.

9. What complications may develop after peripheral iridectomy for angle-closure glaucoma, and what steps are advised to avoid these complications?

DR. CHANDLER: There are four main complications which may be encountered after peripheral iridectomy, and mostly they are avoidable.

The first is injury to the lens. That should never occur. If we are not able to make the iris prolapse or present in the wound by separating the lips of the incision, we should use nothing but smooth forceps to grasp the iris. We should never use forceps with teeth.

The next complication is a flat anterior chamber. A flat chamber after a filtering operation for open-angle glaucoma is one thing, and quite another thing for peripheral iridectomy for angle-closure glaucoma. We presume that the reason we are doing this relatively simple operation of peripheral iridectomy is because the angle is mostly open, as otherwise it would not be effective. So then, if we commence with an open angle, though very narrow, if we have a flat chamber for a very short time, we may succeed in closing all of this angle which was formerly open, thereby completely nullifying the operation and making the glaucoma much worse. In the case of peripheral iridectomy, a flat anterior chamber is a very serious matter and I believe should not be allowed to exist longer than 24 hours. I think it is invariably due to a leaky wound. In any case where, after peripheral iridectomy the chamber is extremely shallow or flat, we should explore our wound and place additional sutures. I think that this will almost never fail to form the chamber and should be done promptly.

The third complication is iritis. There are eyes predisposed to iritis. We know there are certain eyes that, after a foreign body has become embedded in the cornea, will come down with a violent attack of acute iritis. So the simple operation of peripheral iridectomy may initiate severe iritis in some eyes. We have no way of predicting this but we must be on guard and on the lookout for it and not let it get ahead of us. After peripheral iridectomy, it is a good rule, I believe, to dilate the pupils daily with something like Neosynephrine. One must see that the pupil is dilated and not be content with ordering the drops. If we see evidence of a real flare-up of iritis, then we must actively employ all the usual treatment. We must not let the iritis get out of control for the pupil may become filled with an inflammatory membrane, the coloboma may be closed, and the pupillary block may return with a rise of tension, necessitating another iridectomy.

One should not get into any trouble with any of these complications, for almost all of

them are avoidable. Only the last one, malignant glaucoma, is not avoidable. It occurs, as far as my experience goes, only in an eye with angle-closure glaucoma in which the operation has to be done in the presence of an elevated tension. It is a very rare complication, as you all known. Every time a peripheral iridectomy or any glaucoma operation is done on an eye with angle-closure glaucoma in which the tension is high at the moment of operation, there is a risk of malignant glaucoma. In malignant glaucoma, in the postoperative period, there are a shallow or flat anterior chamber and high tension.

I should think that the first thing to do, the other eye presumably being all right, is a prophylactic peripheral iridectomy. Then we can tackle the eye with malignant glaucoma. According to my experience the best operation for the first eye is extraction of the lens, and this should be accompanied by some loss of vitreous anteriorly. Usually that is no problem. But, if you do such a good job that you don't lose vitreous anteriorly at the time of lens extraction, then the malignant course may continue.

The reason I advocate operating on the other eye first is to make certain that malignant glaucoma will not ensue in that eye. You may become so preoccupied with the first eye and all its troubles that the second eye may blow up in an acute attack of glaucoma. Then we know that any operative interference will result in malignant glaucoma in this eye also. Therefore you should hurry up and operate on the fellow eye while the tension is normal.

According to my limited experience, malignant glaucoma has never ensued when operation was done on an eye at a time when tension was normal at the moment of operation. That is another argument in cases of angle-closure glaucoma for employing all the medical means that are at our disposal preoperatively, including Diamox, and trying to get the tension as low as possible at the moment of operation, in order to lessen the chances of malignant glaucoma.

One minor complication is that, once in a while, after peripheral iridectomy for angle-closure glaucoma, in the first week after the

operation we may notice that the chamber is normal but the eye feels a little firm and the cornea is a little hazy. We measure the tension and find that it is elevated even as high as 40 or 50 or 60 mm. Hg. This need not cause great concern because it is not malignant glaucoma if the chamber is normal in depth. Whether the elevated tension is due to closure of the angle from the edema of the peripheral iris or whether it is due to increased protein in the aqueous I don't know. The increased tension responds very well to Diamox and miotic therapy. In a few days the tension returns to normal, and the eye does just as well as an eye in which the tension does not rise in the postoperative period.

10. *What procedure do you follow in recurrent pterygium?*

DR. FRY: It has been my practice in handling cases of pterygium and recurrent pterygium to depend mainly on two types of surgery: (1) a complete excision, and (2) a transplant operation whereby the head of the pterygium is carefully removed from the cornea and is transplanted to a new position under the conjunctiva. It may be done in the fashion of the McReynolds operation and transplanted below the cornea, or it may be divided, one limb above and one limb below the cornea.

I live in an area where severe recurrence of pterygia is not seen frequently. However, I was impressed a number of years ago with an article that appeared in the *British Journal of Ophthalmology* which reported a remarkable series of good results from a method which I have quoted for a number of our graduate students. The pterygium is elevated from the cornea and freed well back, then phenol is applied to the undersurface allowing the pterygium to retract and find a new position away from the cornea. The reported results were remarkable.

There are two other available modes of treating pterygia. The first is X-ray radiation. The second is beta radiation. Both of these forms of radiation therapy need, I think, to be done under supervision so that the dosage is controlled and secondary prob-

lems, such as glaucoma and lens damage, are minimized.

A third method is to excise the pterygium with a fairly deep area of the underlying corneal tissue and with a layer of scleral tissue. The defect may be replaced entirely by new corneal tissue from a donor eye.

11. *What are your ideas as to the cause of flat chambers after filtering operations? What complications may result from this condition? In your opinion, can postoperative flat chamber be avoided by careful study or selection of cases for filtration surgery? What is the treatment for this complication?*

DR. MEYER: Flat chamber after a filtering operation is frequently caused by a button-hole or other leak in the conjunctival flap, or inadequate suturing of the conjunctival flap edges. A drop of fluorescein on the flap will occasionally reveal a trickle of aqueous on the anterior conjunctival surface. The presence of a choroidal detachment may result in a flat chamber. It is sometimes difficult to tell which factor is present first. It is also possible that the surgical trauma at the time of surgery may cause an alteration in aqueous formation, either decreasing the formation or increasing the outflow, with a resultant flattening of the chamber. A shallow chamber following a filtering operation probably has less significance than a flat chamber following cataract surgery, as such flat or shallow chambers usually deepen or reform in a few days if left alone. However, after cataract surgery, a flat chamber remaining for any length of time may result in secondary glaucoma later on.

If the chamber remains abnormally flat, anterior and posterior synechias may develop, followed by increases in lens opacification. A pupillary block, as described by Dr. Chandler, may develop later from such synechias.

Careful study of the chamber angle and lens with the slitlamp preoperatively may reveal a lens larger than normal, or situated more anteriorly. If so, an iridencleisis is preferable to trephination, as one can more easily avoid injury to the lens during surgery.

The treatment of this complication consists of repair of a buttonhole in the flap, if present, or further suturing of the conjunctival edges, if at fault. Mild cauterization of the bleb area with an actual cautery or with trichloroacetic acid may be indicated. If the bleb is intact, it may be necessary to perform a posterior sclerotomy to release the suprachoroidal fluid, and inject air into the anterior chamber, with the aid of an Amsler needle, to deepen the chamber. The sclerotomy is made four mm. posterior to the limbus, and the Amsler needle is inserted into the lower part of the cornea.

If a pupillary block is present, mydriatics may be tried to break the synechias and, if necessary, may be followed by an iridectomy or iridotomy. Incision of the anterior vitreous face has also been recommended.

12. *How do you diagnose and treat late infection of the filtering bleb after a trephination or an iridencleisis operation?*

DR. SACHS: It is not difficult to diagnose this condition. The patient complains of pain, visual disturbance, photophobia, tearing, and redness; there is active inflammation, a dirty yellowish color in the bleb, and cells and often hypopyon in the aqueous. Years ago, when more trephining operations were done, this was more common than today. As for treatment, after making smears and cultures, we use, topically, a combination of polymyxin and neomycin solutions and hot fomentations and, systemically, antibiotics. Fortunately the prognosis is not bad in most cases, although occasionally, if the eye is not seen early, it does have a frank endophthalmitis and does not do well. In a few patients I have seen such infections come on after a respiratory infection and, starting with a conjunctivitis, spread to the bleb. As a prophylactic measure I believe that after a trephination or iridencleisis operation some kind of antibiotic solution, such as sodium sulfacetamide, should be given routinely.

DR. THORPE: Would you care to comment on those patients who have a subacute blepharitis and are prone to develop this type of infection?

DR. SACHS: My only suggestion would be to treat the blepharitis.

DR. THORPE: Yes, it would be very important to treat the blepharitis, and have cultures and sensitivity tests so that the operation would be done only at the most opportune time.

13. *If the vitreous is found to be completely fluid and the eye collapses following section for cataract extraction, how would you proceed with the operation? What is the prognosis?*

DR. CHANDLER: I think the first principle is not to be disturbed by encountering completely fluid vitreous. Just proceed with the operation in the way planned. If you like to slide the lens, slide it. If you like to tumble it with forceps or to use an erisophake, do so. I don't think there is any reason for rushing for the loop in these cases. Practically all the fluid has run out of the eye after the section anyway, so what difference does it make if a few more drops of fluid run out while you are finishing the extraction of the lens? It is my experience that there is much more risk of rupturing the capsule if the lens is delivered with the loop than if it is removed in the usual way. The important thing is to get the lens out in capsule if possible.

Suppose you ordinarily employ two sutures. In those eyes that have collapsed, the sclera buckles under the cornea and the chamber cannot be reformed with fluid. If you send the patient back to his room in that condition, you will find, when you examine the eye the next morning, that it is still in the same collapsed condition. So you had better do something about it in the first place. The whole point is that you must place enough additional sutures so that the wound is held in apposition and the eye will hold the saline. It is always necessary to place additional sutures, maybe a total of four, five, or six, so that the wound is held in apposition and the sclera cannot buckle under the cornea. Then, at the conclusion of the operation the eye is filled with saline. These eyes as a rule do remarkably well: the vitreous clears promptly and the visual result is

good. To be sure, a few patients will develop detachment of the retina but other patients do that also. I do not believe the incidence of detachment of the retina is much higher in these cases than in uncomplicated ones.

14. *If cataract surgery is contemplated in the presence of a well filtering bleb, what procedures with regard to the incision and its enlargement offer the minimal amount of postoperative complication?*

DR. FRY: In my opinion, the best way to make the cataract incision is to make it in the usual way so that the incision is opened upward. The incision, I think, is preferably corneal so that it comes out just anterior to the bleb. Some incisions come out partially in the bleb, and I feel that this is a highly satisfactory way in which to handle the situation. I would not recommend extraction from below or from either side.

15. *What is the most common error in technique in performing an iridencleisis leading to an unsatisfactory result? What do you do if there is a meager or nonexistent bleb following this type of surgery?*

DR. MEYER: The placement of the incision in iridencleisis is very important. If you place your incision too far forward, you will produce a corneal shelf over which the iris cannot spontaneously prolapse easily or at all. You will then have to enter the chamber with forceps and pull the iris down, then up and out, in order to incise it. This is an unsafe procedure. If the incision is placed too far posteriorly, the ciliary processes may prolapse and the vitreous be disturbed, resulting in vitreous loss or incarceration. If the incision is made with a keratome, on entering the chamber, the point may strike and injure the corneal endothelium or the anterior lens capsule. An incision ab externo is preferable and safer than using a keratome or Graefe knife. If the incision is too large, the iris pillars may not hold in the scleral wound, and will return to the anterior chamber a day or two postoperatively. An attempt should be

made to place the incision anterior to the line of Schwalbe.

If a meager or nonexistent bleb follows this type of surgery, one should make accurate checks of the intraocular pressure to ascertain if the tension is within normal limits. Many iridencleisis operations function well with flat blebs. If the operative technique was faultless and the intraocular pressure is elevated, one would hesitate to do a second iridencleisis on the same eye. A trephination may be tried at another place. If the bleb remains flat due to hemorrhage, operative trauma, or inflammation, one could consider repeating the operation in another area.

16. *What is the cause and treatment of partial ptosis following iridencleisis, trephination, cataract surgery, or enucleation?*

DR. SACHS: I have not encountered this problem to any great extent after cataract or glaucoma surgery. In most cases the eye opens well after some weeks. If the lid does droop a little, I comfort the patient by pointing out that sooner or later the second eye will have to have cataract extraction and then the two lids will match. It would be interesting to know if ptosis follows the same type of surgery done under general anesthesia. If it does not, I suspect that injections into the lid and the retrobulbar injection may be factors. Another possibility may be the voluntary squinting on the part of the patient, because of photophobia and irritation due to the sutures and so forth, which may become a habit. Another thought is the possibility of a slight enophthalmos that may occur after operation. At any rate, I feel there is no need to do anything about it.

The same problem after enucleation is a different story. If the rectus muscle is tied into the implant too low, or the superior oblique muscle becomes entangled with the rectus muscle, or if the implant slips downward, ptosis may result. A resection of the levator or another form of ptosis operation would be indicated.

Jesse M. Levitt,
Recording Secretary.

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OPHTHALMIC RESEARCH

In 1956, medical research in the United States entered a new era. In June of that year, Congress established a new national policy: that henceforth, the United States would try to conquer disease through research, whatever the cost. In 1958, the 85th Congress appropriated 294 million dollars to the National Institutes of Health to support medical research. The appropriation for the

National Institute of Neurological Diseases and Blindness was 29.9 million dollars and of this, 17 percent, or approximately five million dollars, was allocated to ophthalmic research. This amount was far in excess of what had been requested and reflected congressional concern regarding medical research. The results of the recent election suggest that the policy of generous federal support for research will be continued.

Those concerned with the impact of these increased funds on medical research will be interested in two monographs which have appeared recently. The first, *The advancement of medical research and education through the Department of Health, Education, and Welfare*, contains the final report of Secretary Fulsom's consultants on medical research and education, headed by Dr. Stanhope Bayne-Jones, and is available from the Superintendent of Documents, United States Government Printing Office, Washington 25, D.C. (60 cents). The second, *A new era in medical research*, presents the results of a survey of medical leaders sponsored by Merck, Sharp, and Dohme Research Laboratories and is available from them. These documents reflect the recognition of a permanent role of the Federal Government in research and present a realistic appraisal of the effect of this support on medical schools, hospitals, and investigators. The report of the secretary's consultants may well establish the future policies of the National Institutes of Health, although Secretary Fulsom, who appointed the group, has since retired.

The expenditures for medical research by the Congress just adjourned were far in excess of those anticipated by the consultants and it seems likely that their projection of a federal appropriation for medical research of 500 million dollars in 1970 will be exceeded long before that. The consultants anticipate that by 1970 philanthropy and industry will provide an annual amount nearly equal to the federal appropriation. This would necessitate private philanthropy donating approximately 100 million dollars a year, three times the present level. Industry would have to spend and give more than 300 million dollars a year, again nearly tripling their present contribution.

The Merck, Sharp, and Dohme survey, which was published prior to the secretary's consultants' report, reflects a wide diversity of attitude of investigators and administrators concerning research and the role of the Federal Government. There is unanimity of

opinion that there is a critical need for more and better research people. There is a shortage of personnel in general, as well as a shortage of outstandingly talented people. In this field the secretary's consultants suggest that training grants for scientists, which have now become an important aspect of the National Institutes of Health, be granted in such a manner as to enable the medical school or other medically related institutions to establish institutional goals rather than primary consideration being given to the need of the individual research workers.

All agreed that there was greater need for basic research. There has been frequent criticism that the general tendency to organize medical research in disease categories (cancer, heart, and so forth) has led to too many applied studies and too little fundamental investigation. The secretary's consultants, however, believe that the categorical approach does not prevent basic research but suggested that drug development and the like was more properly a function of industry. It was generally agreed that short-term research projects are upsetting and a proper period for support is five years.

These findings are of interest and importance to ophthalmology and to ophthalmic research. To judge by nothing other than the many special supplements to THE AMERICAN JOURNAL OF OPHTHALMOLOGY, basic research in ophthalmology is not only vigorous and productive, but includes nearly every fundamental discipline. Recently, too, the large number of studies being done in the field of vision and perception by psychologists, physicists, and biochemists have become better known to ophthalmic investigators. Symposia, scientific meetings, and similar gatherings bring together a variety of disciplines for interchange of ideas. Despite this background, however, there is a tendency to regard research in ophthalmology and the function of the eye as category-types of study. It is encouraging that the two reports are not critical of categorical approach and that it is not necessary for ophthalmic lead-

ers to stress that ophthalmology is not a field of limited scope.

Research in ophthalmology in years past has been most productive in eliminating many blinding diseases. The antibiotics, the steroids, and the autonomic drugs have markedly modified the clinical practice of ophthalmology during the past two decades. The majority of these advances were made outside of ophthalmic laboratories, but they could never have been applied to blinding diseases if it was not for the existence of ophthalmically oriented laboratories in which these advances could be studied and applied.

At present two of the most pressing needs of ophthalmology and ophthalmic research are laboratory space and full-time investigators. In cancer and heart research the pattern of career investigators has been well established—scientists of proven ability and high potential are assured of support for life to carry out scientific studies without the requirement of earning a livelihood by teaching, administrative, or clinical practice, with research an avocation. As yet there is no such support of investigators in ophthalmology.

There seems to be no question but that ophthalmology shares with other disciplines the lack of technicians, investigators, administrators, and teachers, but, in addition, inadequate laboratory space which prevents putting these people to good use when they are available reduces the amount of ophthalmic research. The accomplishments of the ophthalmic laboratories established since the war (and of course those established before the war also) indicate very well that if physical space is provided, the laboratories become productive centers of basic, applied, and clinical research.

Frank W. Newell.

METALS AND PLASTICS IN INTRAOCULAR SURGERY*

Ophthalmic surgeons have been keenly exploring the potentialities of implanted inert materials, especially plastics—notably for the

purpose of correcting refractive errors by means of intraocular artificial lenses. Harold Ridley, the first in this field, in 1951 described his method for overcoming the visual defect in cases of aphakia by means of an acrylic lens inserted behind the iris and in front of an intact posterior-lens capsule.^{1,2}

By 1953, however, it was evident that this technique had its limitations. The artificial lens had to be inserted at the same time as an extracapsular cataract extraction was performed so that there was no means of checking the aphakic correction before the implant was inserted; and furthermore patients in whom the posterior capsule had been divided or had been removed were not eligible. Perceiving the possibilities of this technique, other workers, including Strampelli³ in Italy, Schreck⁴ in Germany, and Barraquer Moner⁵ in Spain, evolved an implant placed in front of the iris and behind the cornea, with feet wedged in the anterior-chamber angles and carrying a central optical portion, the correction of which could be modified to suit the requirements of the individual case. An important advantage of the anterior-chamber implant is that it can, and indeed should, be inserted after cataract surgery has been completed, thus enabling the surgeon to minimize the operative trauma to the eye at each session. Trauma to the eye has been further reduced by the introduction of new methods of sterilizing the implants. While polymethyl methacrylate (or "acrylic") is completely inert in the tissues, with the original method of sterilization by cetrimide small quantities of this irritant were adsorbed by the implant, subsequently leaking out into and irritating the eye. Sterilization by ultraviolet light is open to the objection that it degrades the parent chemical, producing an irritant monomer near the surface of the implant, which would have the same effect as cetrimide. Frederick Ridley⁶ has devised a simple and effective method of sterilizing acrylic im-

* Reprinted from *The Lancet*, July 26, 1958, pages 196 and 197.

plants with 10-percent sodium hydroxide.

Unilateral cataract and unilateral aphakia are by no means rare. The disability in such cases is considerable; unaided vision is usually less than 3/60, and the patient is denied binocular vision. In children especially, the useless eye will tend to converge or diverge, and an ugly squint combines with a functionless eye to give the patient a sense of inferiority which may produce serious psychologic trauma. Attempts to use a normal eye with an aphakic one by means of spectacles fail because of aniseikonia amounting to about 30 percent. A contact lens for the aphakic eye will reduce the disparity in image size to about 10 percent, but many patients cannot tolerate even this amount of aniseikonia. An anterior-chamber implant reduces the figure to about three to five percent, which is tolerable.

At this year's Oxford Ophthalmological Congress, Choyce⁷ described 60 cases of unilateral aphakia treated with acrylic anterior-chamber implants. He stressed that cataract surgery must be completed at least six weeks before implantation is undertaken. In most of Choyce's cases binocular vision was restored and in the remainder alternating suppression developed; accordingly diplopia was not experienced even by patients who had previously had diplopia with a contact lens. About a third of his cases had resulted from trauma, and the length of time which had elapsed since the injury was of no consequence; 6/6 vision was restored to some patients as long as 50 years after injury had caused a cataract. If the injury had occurred in early childhood amblyopia ex anopsia was inevitable, and limited the visual result; but patients appreciated the restoration of even slight unaided vision to what they had come to regard as a useless eye. Another third of Choyce's cases were of unilateral senile cataract in patients over 50 years of age, and after operation these too had the use of the two eyes together, instead of having to decide which eye to use. The remaining patients had either heterochromic cyclitis

(all did well) or congenital unilateral cataract (some did well). It is only two years since the first implantation in this series, and it remains to be seen whether Choyce's results stand the test of time and are confirmed by other surgeons; but it seems likely that the problem of the patient with unilateral aphakia who cannot tolerate a contact lens has been solved.

Theoretically, anterior-chamber implants can be put to other uses—for example, the correction of high myopia and other refractive errors in phakic eyes. An opaque implant could be used to enforce occlusion of the good eye in a squinting child who would not tolerate ordinary methods of occlusion—and, after all, removal of these implants is simple. But merely opening the eye, let alone inserting so large a foreign body, must substantially increase the chances of the lens becoming cataractous; and at present there is no justification for inserting anterior-chamber implants into eyes which retain their own crystalline lenses. In cases of glaucoma, fistulizing operations are usually successful in white patients. In the Negro they almost always fail, and much work has been done, especially by Stone, *et al.*⁸ in the U.S.A., on the use of polyethylene wicks and tubes and of tantalum wire. Efforts to replace vitreous by nonliving materials have not so far been successful; transfer of human vitreous seems to offer the best prospect of success at present.⁹⁻¹¹

The possibility of burying implants incompletely within the eyeball has been closely studied in rabbits by Stone, *et al.*,¹² in their search for an artificial cornea. Edge-to-edge union between cornea and acrylic cannot be induced; but if the cornea is split from limbus to limbus, just superficial to Descemet's membrane, an acrylic disc can be slid into this interlamellar space. These discs are well tolerated; later a smaller disc of overlying cornea can be removed by trephining, and still later a similar posterior disc removed via the anterior chamber. Such an opening will remain patent until the natural death of the

animal. This ingenious technique provides an opportunity to study the reaction of the corneal cells to incompletely buried acrylic; but clinically it is not likely to replace the use of human donor material for cases requiring conventional lamellar or full-thickness keratoplasties. Nevertheless Tudor Thomas¹³ has described a penetrating acrylic implant retained in place by an overlying lamellar corneal graft, and has by this means been able to help patients whose eye condition was extremely unfavorable for ordinary methods of corneal transplantation.

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CORRESPONDENCE

TRABECULUM CORNEO-SCLERALE

Editor,

American Journal of Ophthalmology:

"Tempora mutantur et nos mutamur in illis"—an old Roman excuse, perhaps, for not being quite consistent, but still true. Unfortunately, we do not always change with the spirit of the times. While the "one world" idea has been gaining momentum politically, socially, and economically, we have been gradually abandoning a true "one world" idea conceived and executed by the scientific pioneers when the substance of their dis-

coveries was stated in Latin terms for all the peoples of all the world to understand.

A rather wordy introduction, I confess, for the small purpose of speaking up in defense of the expression "trabeculum corneo-sclerale."

Rochon-Duvigneaud,* in his "*Recherches anatomiques sur l'angle de la chambre antérieure et le canal de Schlemm*," published in 1892, used the French equivalent of this term, that is, "Système trabéculaire scléro-cornéen," for the first time. He discusses the individual "trabécule," masses of which make up the "système trabéculaire."

The English equivalent of these terms, "trabecular meshwork" and "trabecular fiber," are just as lucid and we do not have to resort to Latin, but when we do we should know what we are doing.

It has been amusing to see how individual authors who have not lost a feeling for the Latin language, have been avoiding the use of the controversial expressions. Some speak of the "trabeculae" when they refer to the meshwork, which is permissible but does not exactly convey the idea of the meshwork as an entity for which the term "trabeculum" was created. The trabecula, in other words, is the individual component of the trabeculum. In spite of Webster, the term trabecula cannot be used as an alternate for meshwork, as has occurred in publications and exhibits. Elaborating this point, trabecula (corneo-scleralia) would mean the meshwork of several eyes, and the trabecula (corneo-scleralis, if one wants to be specific) will remain the individual building block of the trabeculum corneo-sclerale, the meshwork of an individual eye.

If you are with me in this, dear editor, please, publish this letter. It is the first of its kind I ever wrote but I feel strongly and sadly about our vanishing ability to use this elegant and precise language.

(Signed) Bertha Klien, M.D.,
Chicago, Illinois.

* Rochon-Duvigneaud: *Arch. d'Ophth.* 12:732, 1892, and 13:26, 108, 1893.

NUTRITION IN OPHTHALMOLOGY

Editor,

American Journal of Ophthalmology:

Your November, 1958, issue contains an article, "Ophthalmic Research Institute of Australia," by Dr. J. Bruce Hamilton which in effect gives evidence of the profound influence of nutrition in ophthalmology.

For many years I have been disturbed by the indifference to this sound and logical basis for therapy which the ophthalmologist often has either ignored or has not seriously studied.

During the past seven years I have employed nutrition in my practice and the clinical experience and the results have been most rewarding. By employing adequate and reasonable nutrition with my patients, I have found that the general well-being of the patients is greatly increased.

(Signed) Cecelia Rosenfeld,
Santa Monica, California.

BOOK REVIEWS

THE EYE IN EVOLUTION (System of Ophthalmology, Volume I). By Sir Stewart Duke-Elder. St. Louis, C. V. Mosby Co., 1958. 843 pages, 902 illustrations, 15 colored plates, and 350 marginal sketches, chapter bibliographies, index. Price: \$27.50.

Darwin's theory was launched at the meeting of the Linnean Society on July 1, 1858. The centenary of this event is happily commemorated by a master ophthalmologist who delineates visual evolution in the most comprehensive manner yet achieved. Through his systematic but fascinating array of facts and wonders, Duke-Elder presents the evolutionary perspective of vision with challenging insight. He states that this massive work "is an extension of the first 20 pages of Volume I of the old *Textbook*." Just as truly it is an extension of the following remarks in "The Origin of Species": "If numerous

graduations from a simple and imperfect eye to one complex and perfect can be shown to exist, each grade being useful to its possessor, as is certainly the case; and if such variations should be useful to any animal under changing conditions of life, then the difficulty of believing that a perfect and complex eye could be formed by natural selection, though insuperable by our imagination, should not be considered as subversive of the theory. . . . In living bodies, variation will cause the slight alterations, generation will multiply them almost infinitely, and natural selection will pick out with unerring skill each improvement."

Duke-Elder pays his customary homage to the trail-blazers. Beginning with a patriarchal likeness of Darwin in the frontispiece, successive chapters are introduced appropriately with photographs of Jacques Loeb, Mast, Richard Hesse, Johannes Mueller, Lankester, D. W. Soemmering, Franz, Rochon-Duvigneaud, Casey Wood, Lindsay Johnson, Carl von Hess, Descartes and the contemporaries, von Frisch, Newton Harvey, and Gordon Walls. In this galaxy should have been Le Gros Clark and G. Elliot Smith. For a realistic accent a less venerable portrait of Darwin would be apropos, since he completed his theory at the age of 29 years, though he delayed full publicity for 20 years.

The author evidently appreciates that the ramifications of ophthalmology if pursued to their ultimate ends would embrace almost all knowledge. Hence he has included numerous helpful footnotes and an informative appendix that presents a lucid paleontologic table for those rusty in geology and a zoologic glossary which is a veritable "Who's Zoo." The text, however, adheres closely to the main subject and avoids tempting excursions in cognate fields. This restraint is perhaps regrettable since many mysteries in evolution cannot be fully explored without their aid. Echinoderms are now considered the link between vertebrates and inverte-

brates. Though the homology of the larval form is mentioned, the remarkable discovery of the biochemical shift in this species from arginine phosphate as a muscle metabolite to creatine phosphate is disregarded.

Of the seven volumes comprising Duke-Elder's *Textbook of Ophthalmology*, the first four are now out of print and admittedly more or less out of date. Instead of revising them, Duke-Elder and his colleagues at the Institute of Ophthalmology have embarked on an even more elaborate venture—a 15-volume *System of Ophthalmology*. The comprehensive first volume, written wholly by Duke-Elder himself, augurs well for the high standard of the series. This eye-view of Nature's wonderland forms the foundation of the science of vision and could be read with profit by any prospective ophthalmologist, now in college, for whom it would be a particularly appropriate gift.

James E. Lebensohn.

DER AUGENARZT: VOLUME I. By Karl Velhagen (with the collaboration of G. Badke, F. Hauschild, M. Monjé, F. Müller, H. Pau, H. Rieger, J. Rohen, and K. Velhagen). Leipzig, Georg Thieme, 1958. 710 pages, 295 illustrations. Price: DM 82.20.

In the introduction, Velhagen states that there is a need for a larger textbook on ophthalmology in German intended not so much for the medical student or the general practitioner but primarily for the resident in ophthalmology and perhaps also for the practicing ophthalmologist. He pleads to make allowances for certain shortcomings of the publication. Due to last-minute changes in commitments, some manuscripts were not received on time. This necessitated a somewhat arbitrary arrangement of the chapters in this volume.

The anatomy of the eye is discussed by Johannes Rohen, Mainz. The sequence of the various systems appears whimsical at first glance. It soon becomes obvious that Rohen,

following the suggestion of Benninghoff, bases his arrangement on "functional systems." The first of these systems serves only the light sensation; it consists of retina, pigment epithelium, and choroid. A second system, comprising the lens, its suspensory apparatus, and the ciliary muscle, permits the formation of an image. The third system, represented by the iris diaphragm, guarantees the elimination of certain imperfections of the optical apparatus of the eye. A fourth system, sclera and extraocular muscles, makes it possible to select the desired field of view without regard to the position of the head. The last system, composed of cornea, lids, and lacrimal apparatus, serves the voluntary extinction or instatement of the field of view as well as the lubrication and transparency of the cornea.

Only the utmost economy in phrasing enables Rohen to give such a comprehensive discussion on the anatomy of the eye in the given space. The correlation between the anatomic details and their physiologic significance is brought out extremely well. When of importance, even electromicroscopic findings are included. An especially valuable appendix to this chapter is a presentation of the anatomic findings in the eye of some animals used in ophthalmologic research. Their differences from human eyes are described in minute detail.

The entire chapter requires very concentrated reading. Frequently, one single sentence is in essence the summary of an entire article of recent origin. The chapter would be even more valuable if the bibliography were more complete.

Herwigh Rieger, Linz, discusses the hereditary pathologic conditions of the eye. He mostly limits himself to an enumeration and brief description of some entities that, undoubtedly, will be treated in greater detail in subsequent volumes under appropriate headings. The bibliography of this chapter is very extensive.

Günther Badtke, Halle, has a chapter on

the normal embryology of the human eye. This author does not limit himself to the facts apparent in the microscopic picture. He substitutes "developmental physiology" for "developmental mechanics." He really writes a volume within a volume in such a lucid manner that, in the opinion of this reviewer, no ophthalmologist will be able to put the book down without reading the entire section. A number of finer points omitted in the chapter on anatomy are quite logically found here. It should be mentioned in this connection that—at least in this first volume—there is practically no overlapping and repetition, a frequent drawback of textbooks of multiple authorship. The illustrations (most of them originals) are superb, and the bibliography quite comprehensive. This is perhaps the outstanding chapter of the entire volume and is alone well worth the price of the entire book.

Hans Pau, Münster, in his description of the physiologic chemistry of the eye wisely limits himself to general principles. The material offered should be adequate for the student and practicing ophthalmologist. It is not intended for those interested in research, hence the incomplete bibliography.

Manfred Monjé, Kiel, calls his chapter "The light sense: Physiology of the eye." After an erudite presentation of the physiologic contrast and of accommodation (he justifies his belief in sympathetic in addition to parasympathetic innervation of the ciliary muscle quite convincingly!), he elaborates in great detail on color vision—both normal and abnormal. In particular, there is a wonderful description of the anomaloscope and its use which makes one wonder why this instrument is not used more widely in this country. The physiologic basis of the electroretinogram (both single and flicker stimuli) receives a splendid interpretation.

Karl Velhagen and Fritz Hauschild, Leipzig, have assigned to themselves the pharmacology of the eye. This excellent chapter is entirely up to the standard of the other sections and thoroughly up to date. Although

this is not a controversial question from the pharmacologic point of view, I was surprised by the conclusion that hyaluronidase, which enhances the effect of lowering the intraocular pressure after retrobulbar anesthesia, is, for that reason, contra-indicated in cataract extraction.

Fritz Müller, Leipzig, writes the final chapter on bacteriology of the eye. This well-illustrated dissertation is quite unique for textbooks of ophthalmology: it contains not only a very detailed discussion of the morphology but also of the staining and culture methods. This should make it equally valuable to the student of ophthalmology and the bacteriologist who is unfamiliar with some of the problems of our specialty.

Even at a first glance one is overwhelmed by the scope of this undertaking. On closer scrutiny it becomes evident that the purpose of this endeavor is not to create another "Kurzes Handbuch" which was primarily a reference work. The textbook under discussion is ideally suited for the resident to acquaint himself in a systematic manner with his chosen specialty.

This volume is the first of three more to follow. Volume II should be available in the fall of this year. Volume III is scheduled for publication in the early months of next year, and the concluding volume should appear late in 1960 or early in 1961.

Some of the chapters that might be singled out as being of special interest are those on malformations by Bladke; on anomalies of refraction and aniseikonia by Sachsenweger; on electroretinography by Schmöger; on the anterior chamber by Remky; on muscle anomalies and pleoptics by Hamburger; on aqueous circulation and glaucoma by Van Beuningen; and on systemic diseases and the eye by Velhagen.

One can only hope that the volumes to follow will maintain the standard set in this first volume. Truly an exciting enterprise, the continuation of which should be watched with pleasurable anticipation!

Stefan Van Wien.

GENERAL OPHTHALMOLOGY. By Daniel Vaughan, Robert Cook, and Taylor Asbury. Los Altos, California, Lange Medical Publications, 1958. 319 pages, illustrated, glossary of ophthalmic terms, index. Price: \$4.50.

This well-illustrated paper-bound book was designed by its authors to "provide a concise yet reasonably complete, up-to-date review of a difficult specialty for use by medical students, general physicians, internists, and resident physicians in ophthalmology. We hope it will serve these groups as a companion volume to the standard texts as well as a quick reference guide to the management of the more common disorders in their daily practice." It might be added that it would prove to be very useful in preparing for the Board Examinations. Drs. Vaughn and Cook are associated with the Department of Ophthalmology, University of California School of Medicine, Dr. Asbury, ex-resident of that department is now assistant professor of ophthalmology, College of Medicine, University of Cincinnati. All are bright, young, energetic men, who have had superb training and considerable clinical experience.

All of the illustrations are in black and white. Some of them are excellent photographs, others beautiful line drawings by Prof. Ralph Sweet of the Department of Ophthalmology, University of California School of Medicine. There are also many useful tables, an excellent appendix of commonly used eye medications, and a vocabulary of terms relating to the eye that will be most useful to the beginner in ophthalmology.

There are 21 chapters covering the entire field of ophthalmology, in outline form, pre-

supposing of course that the reader is either familiar with the usual textbooks or will supplement each chapter with concurrent reading in the textbooks. It cannot, nor is it designed to be, used as a textbook itself. For its limited purpose, the authors have succeeded in giving us a useful and supplementary tool to our studies. Each ophthalmic resident should own a copy.

Derrick Vail, M.D.

TUMORI ORBITO-PARANSALI. By Fregni, Riccardo, and De Poli, Attilio. Supplement 28 (1957) of *Archivio Italiano di Otologia, Rinologia e Laringologia*.

Ophthalmologists will find this excellent monograph most useful. It is written by an otolaryngologist and ophthalmologist; their collaboration has produced a thorough discussion of the nature, diagnosis, and treatment of neoplasms which proliferate in the orbit and the contiguous paranasal sinuses. The text (333 pages) is clear and authoritative. The clinical discussions are preceded by a thorough presentation of the necessary anatomic, embryologic, and vascular relationships. The major portion of the book is devoted to an account of the authors' clinical experience with (1) orbital invasion by tumors which originate in the nose, the paranasal sinuses and retropharyngeally, (2) tumors which have their origin in the lids, the eyeball or intracranial tissues, and (3) tumors which are primary in the orbit. The differential diagnosis is discussed in a separate chapter. There is a 12-page bibliography.

This monograph is highly recommended.

F. H. Haessler.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Ashton, N. and Mohamed, F. M. **Histological significance of hemispherical bodies in the eye.** *Brit. J. Ophth.* 42:605-609, Oct., 1958.

Hemispherical bodies, found occasionally in Bowman's membrane during microscopic examination, have no apparent significance. The bodies are apparently seen only when the tissues are fixed in a Zenker solution and not in formalin-fixed specimens. These bodies are, in all probability, protein precipitates. (3 figures, 5 references) Lawrence L. Garner.

Fukuda, Masatoshi. **Studies on the nerve endings in the extrinsic eye muscles of the rabbit.** *Jap. J. Ophth.* 2:93-102, May, 1958.

There are five morphologically distinct types of nerve endings in the extrinsic eye muscles of the rabbit. The nerve endings and fibers originate from the motor nerves and the cervical sympathetic. The cells of origin of the afferent fibers are not located peripherally but inside the brain stem. (24 figures, 33 references)

Erwin E. Gaynon.

Pau, H. and Conrads, H. **The regeneration of fine corneal nerves.** *Arch. f. Ophth.* 160:125-130, 1958.

Injuries to the rabbit cornea show that stromal cells participate in the regeneration of nerve tissue and may be transformed into the nucleus and cytoplasm of the Schwann cells. The authors present evidence from microphotographs that the fine nerve fibrils are also formed "in loco" from corneal stromal cells. (3 figures, 11 references) Edward U. Murphy.

Vail, Derrick. **The zonule of Zinn and ligament of Wieger.** *Tr. Ophth. Soc. U. Kingdom* 77:441-499, 1957.

The author studied the suspensory ligament of the lens and compares his findings with those of other workers during the past 100 years. His study was based on 21 cadaver eyes and numerous cataractous lenses. (41 figures, 61 references) Beulah Cushman.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

Bullington, S. J. and Waksman, B. H. **Uveitis in rabbits with experimental**

allergic encephalomyelitis. A.M.A. Arch. Ophth. 59:435-445, March, 1958.

Albino rabbits were inoculated with optic nerve and other nervous tissues and killed tubercle bacilli in mineral oil. Both eyes and the nervous system were studied histologically and clinically. The animals developed allergic encephalomyelitis, optic neuritis, and iridocyclitis but the injections failed to produce uveitis. (6 figures, 4 tables, 27 references)

G. S. Tyner.

Foster, J. B. T., Almenda, E., Littman, M. L. and Wilson, M. E. **Some intraocular and conjunctival effects of Amphotericin B in man and in the rabbit.** A.M.A. Arch. Ophth. 60:555-564, Oct., 1958.

The authors describe experimental inoculation of 13 rabbit eyes with *Volutella* species spores in only four of which infection was established, and poor results of treatment by Amphotericin B. A case of an infection in the eye of a 78-year-old woman which similarly had a poor result even after intraocular treatment is also reported.

The maximum intravenous dose of Amphotericin B tolerated by man is 1.0 to 1.5 mg. per kilo per day, which produces a blood level of the antibiotic no greater than 1.8 mg. per milliliter. Although the level is higher than is necessary to inhibit most species of pathogenic fungi, it is too low to check the growth of the *Volutella* species, which requires a concentration of 10 mg. of Amphotericin B per milliliter. (8 figures, 8 color photographs, 2 tables, 14 references)

G. S. Tyner.

François, J. **A study of the transmission of genes in ophthalmology.** Bull. Soc. belge d'opht. 118:301-332, 1958.

In the beginning of this remarkable report the author refers to the relativity of dominance in genetics and to the frequent incompleteness of this dominance. The risks of transmission of a dominant defect

are probably not extreme except when reinforced by consanguinity. It is of great importance to recognize carriers of pathologic genes because the exact mechanism of genetic action is dependent on the relationship between the carriers of minor manifestations and those with the major manifestations of the whole abnormal symptom complex. In a given case the recognition of a carrier may allow an exact genetic prognosis and a prediction of the transmission of the disease. There are three distinctly different groups of carriers. In Group 1 are those individuals who carry a dominant gene, which however only becomes evident later, both in adult life or senescence, either with all the manifestations of the disease or as forme fruste, in the presence of diminished penetration. Many of the degenerative diseases of old age possibly have a hereditary factor. Among the latter are not only eye diseases such as glaucoma and senile macular degeneration but also systemic diseases such as hypertension, gout, and spondyloarthritis. Group 2 consists of subjects with genes of either incomplete penetrance or expression. Such a person only rarely presents all the specific abnormal manifestations of such a gene. Only a most careful investigation of all the members of an affected family may give the necessary clues. The phacomatoses, the syndromes of Waardenberg-Klein, Ehlers-Danlos, and Van der Hoeve belong to this group, which also includes the myotonic dystrophy of Steinert, the essential familial hypercholesterolemia, the lipoidoses of various forms, cystinosis and cystinuria, the dysostosis mandibulofacialis of Franceschetti and diabetes mellitus. Group 3 comprises individuals who are heterozygous toward an incompletely recessive gene. This group was divided in two subgroups. Subdivision A represents the autosomal recessive hereditary trait. Among persons of autosomal recessive heredity the apparently normal heterozy-

gous individual is seen much more often than the homozygous, afflicted phenotypically. In the presence of so many recessive diseases probably almost everyone carries abnormal genes, which in a homozygous phase would cause disease, the heterozygote being not quite normal, presenting a minor anomaly, equal to an intermediary form. Xeroderma pigmentosum, amaurotic juvenile idiocy, albinism, Wilson's disease, keratoconus and Bardet-Biedl's syndrome are placed in this subgroup. Subdivision B includes intermediary heredity restricted to one sex. Certain genes, bound to one sex, are neither really dominant nor really recessive and therefore produce intermediary phenotypes in heterozygous females. At least eight different ocular afflictions are transmitted in this type of heredity. Keratopathia follicularis spinulosa, external ophthalmoplegia with myopia, megalocornea, congenital ectodermal dysplasias, ocular sex-bound albinisms, choriorderemia, and retinopathia pigmentosa are some of these abnormalities which might be recognized in their preclinical stage with the help of modern detailed techniques. The knowledge about specific characters of heredity is not only significant for the prognosis of a given disease but also makes possible corresponding prophylactic measures. Therefore thorough understanding of these problems is not only essential for research workers but also for the clinician. (7 figures, 1 table)

Alice R. Deutsch.

Hogan, M. J., Zweigart, P. A. and Lewis, A. **Experimental ocular toxoplasmosis.** A.M.A. Arch. Ophth. 60:448-449, Sept., 1958.

The authors found that in guinea pigs neither sulfadiazine nor pyrimethamine prevented toxoplasmic infection of the eye and brain after inoculation of the organisms into the vitreous. (1 table, 1 reference)

G. S. Tyner

Hogan, M. J., Zweigart, P. A. and Lewis, A. **Recovery of toxoplasma from a human eye.** A.M.A. Arch. Ophth. 60:548-554, Oct., 1958.

The authors describe their experiments in the isolation of a low-virulence toxoplasma from a patient's eye 20 years after birth. A chorioretinal scar had been seen in the macular area of the eye at the age of 18 months. (13 figures, 1 reference)

G. S. Tyner.

Kaufman, H. E. and Kaufman, E. **Human amnion-cell tissue culture.** A.M.A. Arch. Ophth. 59:342-349, March, 1958.

The authors report that amniotic tissue seems to afford a simple, inexpensive, rapid, and reliable culture medium for virus identification. Identification of herpes simplex virus can be made in sixteen hours. The authors report the cytopathogenic changes with herpes simplex and adenovirus and some additional properties of the tissue. (12 figures, 23 references)

G. S. Tyner.

Lorenzen, Uwe Karsten. **Comparative investigations on the hemagglutination test of Middlebrook-Dubos in the aqueous and serum of patients with uveitis.** Klin. Monatsbl. f. Augenh. 133:529-534, 1948.

The aqueous of 26 patients was examined; 18 had an anterior uveitis and eight a choroiditis. The hemagglutination test was read for fast (2 hours) and slow (20 hours) antibodies. No antibodies for tuberculosis were found in the aqueous of any of the patients. In three of the patients the titer in the serum was 1:8 or higher. (14 references)

Frederick C. Blodi.

Marin-Amat, M. **Ocular allergies and diseases of auto-aggression.** Arch. Soc. oftal. hispano-am. 18:385-425, May, 1958.

The author provides a brief review of the literature on immunity, anaphylaxis, allergy, the relation between infection

and allergy, autoantigens, and the characteristics of cellular and humoral reaction. It is believed that the cellular reaction which is slow, progressive, and permanent is caused by the lipid fraction of microbial antigens, while the acute, intense, and transitory humoral reaction is caused by the protein fraction. The characteristics of the reticuloendothelial system and local ocular immunity are discussed, and the data revealed by research on the Koch bacillus with the electronic microscope are mentioned. The literature on the allergic factor of ophthalmic migraine, Vogt-Koyanagi syndrome, Harada's disease, ocular tuberculosis, syphilis and toxoplasmosis, and the therapy for these diseases are thoroughly discussed. (1 table, 23 references) Ray K. Daily.

Reed, H., Wilt, J. C. and Tushingham, G. **A preliminary report on the self-sterilizing property of vitreous.** A.M.A. Arch. Ophth. 60:361-365, Sept., 1958.

In contrast to the widespread belief that vitreous has a lower resistance to infection, the authors' experiments indicate that human vitreous, when stored at 4°C, has a self-sterilizing property. This action is not present in rabbit and dog vitreous and the mechanism is not known. *Bacillus subtilis* was the only exception among many organisms used. (6 figures, 3 tables, 5 references) G. S. Tyner.

Vassilev, Vasco. **Contribution to the study of the frequency of ocular manifestations in leptospiroses.** Ann. d'ocul. 191: 514-528, July, 1958.

The author reports 58 cases of proven benign leptospirosis. Of this group seven (12 percent) had an iridocyclitis. In a second group of 93 patients with uveitis there were positive agglutinins for leptospirosis in the blood of 18. This gives an incidence of 16 percent. The nine types of *leptospira* found in Bulgaria were all represented in this series of patients and

there does not seem to be an affinity for any one type nor is there an affinity of any type for any special part of the eye. (2 tables, 46 references) David Shoch.

Wolkowicz, M. I., Hallett, J. W. and Leopold, I. H. **Experimental studies on Cx-reactive protein in rabbit aqueous.** A.M.A. Arch. Ophth. 59:389-405, March, 1958.

The authors studied the possible role of the C-reactive protein (CRP) in uveitis. This protein is found in sera of patients with active inflammatory or necrotizing disease. The experiments show quite conclusively that a similar protein, CxRP, can be produced within the globe in experimental uveitis. (13 figures, 12 tables, 20 references) G. S. Tyner.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Abramson, I. Jr. **Local applications of steroids in ophthalmology.** Bull. et mém. Soc. franç. d'opht. 70:553-555, May, 1957.

The various components of Methymid and Metreton are described and the indications and contraindications for the use of these drugs are enumerated.

Alice R. Deutsch.

Alpern, M., Ellen, P. and Goldsmith, R. I. **The electrical response of the human eye in far-to-near accommodation.** A.M.A. Arch. Ophth. 60:592-602, Oct., 1958.

A technique is described for the measurement of the D.C. shift in potential in the human eye that is generated by change in accommodation of the eye from far to near or from near to far. The source of this potential is uncertain. (7 figures, 12 references) G. S. Tyner.

Aoyagi, Tuneyuki. **Biochemical studies on the changes of the cornea and aqueous humor after death.** Jap. J. Ophth. 2:213-220, Aug., 1958.

The reductic ascorbic acid and glutathione in the bovine cornea decreased gradually at room temperature. The decreasing rate was much higher in summer than in winter, and decreased least under refrigeration. The reductic rate decreased least when the eyeball was preserved in serum, next in Ringer's solution, and was greatest in normal saline. The cornea absorbed fluid and increased in weight in the same order. (5 figures, 9 references)

Irwin E. Gaynon.

Bartley, S. Howard. **Some facts and concepts regarding the neurophysiology of the optic pathway.** A.M.A. Arch. Ophth. 60:775-791, Oct., 1958.

The author discusses 1. the theory of alternation of response, 2. brightness enhancement, 3. factors underlying sensory fusion from intermittent stimulation, and 4. the nature of the distribution of photic radiation on the retina. (12 figures, 27 references)

G. S. Tyner.

Borello, Carlantonio. **Thromboelastographic research on the secondary aqueous in rabbits.** Rassegna ital. d'ottal. 27: 208-221, May-June, 1958.

In the plasmoid aqueous there is present a fibrolytic substance derived from plasmogen and from its proactivator. In fact the addition of streptokinase to the plasmoid aqueous determines the activation of an intense fibrolytic process which then dissolves the fibrin of the first aqueous. Streptokinase acts indirectly on the predecessor of plasminogen and activates the fibrinolytic action. (4 figures, 35 references)

Eugene M. Blake.

Boyer, H. K., Suran, A. A., Hogan, M. J. and McEwen, W. K. **Studies on simulated vitreous hemorrhages.** A.M.A. Arch. Ophth. 59:333-336, March, 1958.

This study concerns the effect of enzymes, surface active agents, and urea upon experimentally produced vitreous

hemorrhages. Urea was the only agent which accelerated the rate of absorption but proved too toxic to the eye for clinical use. The substances tested were injected directly into the posterior portion of the vitreous. Among the substances tested were hyaluronidase, streptokinase-streptodornase, and trypsin. (1 table, 11 references)

G. S. Tyner.

Choi, Chang S. **Penetration of pyrimethamine (daraprim) into ocular tissues of rabbits.** A.M.A. Arch. Ophth. 60:603-611, Oct., 1958.

Experiments on rabbits are described. Regardless of the single dose given, no pyrimethamine was detected in the aqueous or vitreous of normal rabbit eyes. It was found in the uvea, however. Subconjunctival injections penetrated into the aqueous. Six milligrams per kilo of body weight was the maximum safe dose intravenously. Intravitreal injections produced severe endophthalmitis. (4 figures, 3 tables, 16 references)

G. S. Tyner.

Cogan, D. G., Kuwabara, T., Richardson, E. P. and Lyon, G. **Histochemistry of the eye in metachromatic leukoencephalopathy.** A.M.A. Arch. Ophth. 60: 397-402, Sept., 1958.

The authors report the finding of a metachromatic substance in retinal ganglion cells of two patients with metachromatic leukoencephalopathy. (5 figures, 6 references)

G. S. Tyner.

Cogan, D. G., Kuwabara, T., Silbert, J., Kern, H., McMurray, V. and Hurlbut, C. **Calcium oxalate and calcium phosphate crystals in detached retinas.** A.M.A. Arch. Ophth. 60:366-371, Sept., 1958.

Monohydrated calcium oxalate and calcium phosphate were found in the outer layers of detached retinas. Such deposits are rarely found in other parts of the body. The cause is not known. (5 figures, 11 references)

G. S. Tyner.

de Conciliis, Ugo. **Adenosintriphosphoric acid in cataracta complicata from experimental anaphylactic uveitis.** Arch. di ottal. 62:83-87, Jan.-Feb., 1958.

By a recent micromethod determining ATP in rabbit lenses, the author showed the substance to diminish before the onset of opacities due to induced uveitis. (1 table, 14 references) Paul W. Miles.

de Conciliis, U. **Carbonic anhydrase activity of the lens in rats fed a diet free of zinc.** Arch. di ottal. 62:67-72, Jan.-Feb., 1958.

There was no appreciable difference. (1 table, 18 references) Paul W. Miles.

Correa, Carlosalberto. **A new cycloplegic drug.** Rev. brasil. de oftal. 17:345-353, Sept., 1958.

The author compares a new cycloplegic drug, Mydriaticum, Ro 1-7683/17, prepared by Roche Laboratories with homatropine and Cyclogyl. The new drug is free from irritation of the conjunctiva, is a very effective mydriatic of more rapid action than the other two older drugs tested and is an excellent cycloplegic. The effect on the ocular tension varies, but in the great majority of cases it is insignificant. The new drug may also have advantages in cataract surgery. (4 graphs 2 tables) Walter Mayer.

De Simone, Silvio. **Research on the water and nitrogen content of rabbit cornea in experimental keratitis neuroparalytica.** Arch. di ottal. 62:151-155, March-April, 1958.

An eye in each of five rabbits was treated with retrobulbar alcohol and novocaine in the region of the ciliary ganglion. After six days corneal lesions appeared. After about 12 days the corneas were opaque and the eyes were removed. The normal corneas showed 83 to 85 percent water, while the diseased corneas showed 90 to 93 percent water. There was from

14.2 to 15.4 percent nitrogen in both normal and treated corneas. (2 tables, 4 references) Paul W. Miles.

De Simone, Silvio. **Research on alkaline phosphatase of the rabbit cornea in experimental neuroparalytic keratitis.** Arch. di ottal. 62:77-82, Jan.-Feb., 1958.

Previous studies had shown that trophic corneal changes followed alcohol injury to the ciliary ganglion, with reduced corneal glycolysis. By a histochemical method in five rabbits, similar corneal changes were demonstrated, with a thickened epithelium slightly diminished in alkaline phosphatase. (2 figures, 15 references) Paul W. Miles.

De Simone, S. **Research on glucose content of rabbit vitreous during experimental ditizone diabetes.** Arch. di ottal. 62:45-52, Jan.-Feb., 1958.

Diabetes from diphenylthiocarbazon was attributed to inactivation of the beta cells in the islets of Langerhans. The effect is at first temporary, so that when the ditizone is stopped, there is hypoglycemia from release of stored insulin. After intravenous ditizone in rabbits, there appeared slight retinal vein dilatation, peripheral fluffy exudates, and choroidal pigment and vascular degeneration. After 10 to 12 days there were lens changes.

The glucose content of plasma, vitreous, and aqueous was determined on six normal rabbits at the onset of the experiment, and after 15 days and 30 days. Plasma glucose in gram percent was 1.24, 2.25, and 4.12, while vitreous glucose increased to .70, 1.12, and 1.91, and aqueous glucose increased to 1.10, 2.01, and 3.93. Thus, glucose increased in vitreous and in aqueous in proportion to that in plasma. (1 table, 23 references) Paul W. Miles.

D'Esposito, Mario. **Further inquiry into the relationship between melanophore hormone and retinal metabolism.** Arch. di ottal. 62:145-149, March-April, 1958.

Previous studies had shown that oxidation in the retina of the rat is inhibited by melanophore hormone, but that oxygen consumption in the frog retina is increased. Ringer's solution had been used in each case. In the present study it was shown that Ringer's solution alone increased the oxygen consumption, causing an error in the frog retina tests. A fortified Ringer's solution was developed which contained, in addition to the usual constituents, nicotinamide, ATP, DPN, cytochrome C, and vitamin A. When this was used, both rat and frog retina showed an inhibition of oxygen consumption by melanophore hormone. (1 table, 4 references)

Paul W. Miles.

Di Martino, C. **Experimental research on the action of Meprobamate in ophthalmology.** Arch. di ottal. 62:131-144, March-April, 1958.

The pharmacologic properties of Meprobamate are discussed. It is considered valuable preoperatively and for the psychic disturbances in patient with glaucoma. Experiments showed no direct action on the intraocular pressure. (1 figure, 51 references) Paul W. Miles.

Dische, Zacharias. **Physiological chemistry of the eye.** A.M.A. Arch. Ophth. 60: 632-685, Oct., 1958.

An extraordinarily detailed review of the literature of the physiologic chemistry of the various eye structures for the year 1957. (127 references) G. S. Tyner.

Dorello, U. and Scorciarini Coppola, A. **Clinical and experimental evaluation of a new cortisone derivative, the trimethylacetate of prednisolone.** Boll. d'ocul. 37: 321-344, May, 1958.

The authors found that the trimethylacetate of prednisolone was well tolerated when applied topically and was more effective than hydrocortisone in inhibiting horse serum uveitis in rabbits. It was

used locally in 61 cases and found to be clinically effective. In experimental lesions of the cornea it was found to inhibit wound healing to a small degree. (16 figures, 25 references)

Joseph E. Alfano.

Euler, Hans Helmut. **The effect of hyaluronidase on the cocaine anesthesia of the human cornea.** Klin. Monatsbl. f. Augenh. 133:500-506, 1958.

These experiments were done on normal patients. The corneal sensitivity was tested with Frey's hairs. Hyaluronidase was dropped three times into the right eye, and physiologic saline solution into the left eye; 20 minutes later one drop of cocaine was instilled into both eyes. The right cornea, which had been pretreated with hyaluronidase, regained its normal sensitivity faster than the control eye. (1 figure, 2 tables, 28 references)

Frederick C. Blodi.

Frezzotti, R. and Scagnetti, A. **Fractions of soluble proteins in adult cataractous lenses.** Gior. ital. oftal. 10:119-126, March-April, 1957.

Examination by a modified method of electrophoresis of 51 cataractous lenses from adult subjects revealed that only one fraction was obtained in 13 cases, two fractions in 36 cases, and three in two cases. It seems that the number of fractions is dependent more on the type of cataract than on the age of the patient. (2 figures, 3 tables, 28 references)

V. Tabone.

Fukasawa, Aiko. **The effect of electrical stimulation of the hypothalamus on the tissue respiration of the iridociliary body and on the protein content in aqueous humor.** Jap. J. Ophth. 2:201-207, Aug., 1958.

Stimulation of the b-sympathetic zone of the hypothalamus in the rabbit elicited extreme dilatation of the pupil, exoph-

thalmus, a decreased respiratory quotient and metabolism of the ciliary body with a marked increase in the protein nitrogen content of the aqueous due to the increased permeability of the ciliary membrane and the transfer of serum protein to the anterior chamber.

Stimulation of the c-parasympathetic zone caused a miosis, enophthalmus, very little change in the respiratory quotient and a minimal increase of the protein nitrogen in the aqueous. (7 tables, 10 references)

Irwin E. Gaynon.

Goertz, Heinz. **Results of a five-year experience with Diamox.** Klin. Monatsbl. f. Augenh. 133:203-212, 1958.

The drug was used on 772 patients with all types of glaucoma. In 154 patients it was given after other treatment had failed. In this group Diamox was most effective in patients with aphakic glaucoma. It was also highly effective in acute attacks and in secondary glaucoma. (3 figures, 1 table, 47 references)

Frederick C. Blodi.

Gonzales-Jimenes, E. and Leopold, I. H. **Effect of dichlorphenamide on the intraocular pressure of humans.** A.M.A. Arch. Ophth. 60:427-436, Sept., 1958.

The authors experimented with dichlorphenamide to see whether it is better than acetazolamide (Diamox). In vitro tests indicate that it is 30 times as effective. In vivo tests show lowering of intraocular pressure with lower dosage which lasts six hours from a single dose. Tonographic studies show inhibition of aqueous humor formation in normal and glaucomatous eyes. Both drugs have side effects, but some patients tolerate dichlorphenamide better. (2 figures, 7 tables, 20 references)

G. S. Tyner.

Graham, P. A. **Benzocaine-urethane solution in ophthalmology.** Brit. J. Ophth. 42:589-594, Oct., 1958.

A solution of benzocaine in urethane is

employed to block branches of the seventh nerve in patients with intractable blepharospasm; the resulting impairment of conduction lasts several weeks. To a 40-percent solution of urethane two percent crystalline benzocaine is added. After standing for 24 hours the solution is filtered and sterilized by autoclaving. The solution will keep well and remain sterile. The results were not uniformly good but certainly effective enough to warrant further investigation. When used as a retrobulbar injection in nine patients who had a painful, blind eye, the results were good in six. (10 references, 3 tables)

Lawrence L. Garner.

Grant, W. Morton. **Further studies on facility of flow through the trabecular meshwork.** A.M.A. Arch. Ophth. 60:523-533, Oct., 1958.

The author describes his method of investigating the influence of trabeculotomy or trabeculectomy on the facility of outflow of aqueous. He calculates that 75 percent of the total outflow of the fluid traverses the trabecular meshwork. He believes from his experimental work that opening or removing the trabecular network may be of value in open-angle glaucoma. (2 figures, 1 table, 5 references)

G. S. Tyner.

Hartline, H. K. **Inhibitory interaction in the limulus eye—Abstract.** A.M.A. Arch. Ophth. 60:734-738, Oct., 1958.

Inhibitory interaction in the retina results in the enhancement of brightness contrast. (1 figure, 5 references)

G. S. Tyner.

Ide, T. and Shimo-oku, M. **Vitamin A content in liver and B₁ concentration in blood of mice maintained on vitamin A or B₁ deficient diet.** Jap. J. Ophth. 2:197-207, Aug., 1958.

Both the vitamin B₁ concentration in the blood of animals fed with vitamin A-

deficient diet and the vitamin A content of liver of animals fed with vitamin B₁-deficient diet decreased gradually as the experiment was continued. (3 tables, 4 references)

Irwin E. Gaynon.

Johnson, E. Parker. **The character of the B-wave in the human electroretinogram.** A.M.A. Arch. Ophth. 60:565-591, Oct., 1958.

The author describes in detail his experiments with the human electroretinogram. His work was directed mainly to the behavior of the scotopic b-wave. (21 figures, 74 references)

G. S. Tyner.

Kinsey, V. E. and Palm, E. **Penetration of sodium thiocyanate into the posterior and anterior chambers.** Brit. J. Ophth. 42:620-625, Oct., 1958.

The authors' data were found to be consistent with a flow rate of 1 to 1.25 percent per minute and with the hypothesis that Na enters the posterior chamber unidirectionally whereas SCN enters by a two-way diffusional process. They are also consistent with a hypothesis that both Na and SCN enter the anterior chamber by flow from the posterior chamber and diffusion from the blood across the iris-aqueous barrier. Both ions are believed to leave the anterior chamber by flow as well as by back diffusion through the iris. (2 figures, 5 references)

Lawrence L. Garner.

Krinsky, Norman I. **The lipoprotein nature of rhodopsin.** A.M.A. Arch. Ophth. 60:688-694, Oct., 1958.

Rhodopsin, the molecule which transduces light energy into a nervous impulse leading to vision, is a lipoprotein. In this paper the relationship of the lipid and protein portion of the molecule is discussed. (3 figures, 27 references)

G. S. Tyner.

Kutschera, E. **Clinical experiences with the Ecomytin-hydrocortisone ointment.**

Klin. Monatsbl. f. Augenh. 133:273-275, 1958.

This ointment is a combination of neomycine, amphotomycine and hydrocortisone. The result was apparently good in 29 cases of anterior uveitis, 10 postoperative disturbances, and in 66 out of 74 patients with external affections. (1 table, 1 reference)

Frederick C. Blodi.

Langham, Maurice D. **Specificity and comparative activity of the carbonic anhydrase inhibitors Neptazane and Diamox on animal and human eyes.** Brit. J. Ophth. 42:577-588, Oct., 1958.

Rabbit, cat, and human eyes were used to evaluate the tension-lowering qualities of Neptazane and Diamox. The results seem to indicate that Neptazane is approximately two to three times more active or potent than Diamox. In man a single dose of 250 mg. of the former was found to depress the tension for approximately 20 hours. The mechanism of action of the two drugs is essentially the same, since both depress the rate of secretion by the ciliary body, but in the case of Neptazane, the effect is almost immediate and of prolonged duration. (3 tables, 11 figures, 13 references)

Lawrence L. Garner.

Laue, H. **Technique of measuring retino-cortical time in rabbits.** Arch. f. Ophth. 160:171-180, 1958.

Simultaneous electroretinograms and electroencephalograms are taken. (3 figures, 2 tables, 13 references)

Edward U. Murphy.

Majima, Yoshinao. **Phosphatase activities in the ocular tissue: changes in activities of ATP-ase and 5-nucleotidase of visual cells by light and dark adaptation.** Jap. J. Ophth. 2:192-197, Aug., 1958.

ATP-ase is instrumental in initiating phosphorylation; its activity is increased

during dark adaptation, and has an important function in the regeneration of visual purple. This takes place in the outer segments of the rods. The activity of 5-nucleotidase is increased one and one half times by light exposure. It plays the role of starter in the metabolic processes of the retina, especially respiration and glycolysis. This is believed to be closely related to the production of phosphoric acid in the retina by light adaptation. (2 figures, 2 tables, 13 references)

Irwin E. Gaynon.

Miller, H. A., Divert, J. and Crouzet, J. **Decamethylene-bis-neostigmine (BC 48) in the treatment of ocular hypertension.** Bull. et mém. Soc. franç. d'opht. 70:518-539, May, 1957.

Decamethylene-bis-neostigmine (BC 48) is the derivative of a quaternary ammonium compound, enforced by coupling two neostigmine molecules through a polymethylene chain with the carbon atoms. It is an inhibitor of cholinesterase and of pseudocholinesterase with additional direct action on the nerve endings. It is water-soluble, but stable only for about one month at room temperature. In 1 to 1/2 percent solutions it causes considerable miosis, ciliary spasm, and reduction of ocular tension by increasing the facility of aqueous outflow; one instillation may reduce the tension for three days and more. Locally it is well tolerated in spite of the accompanying conjunctival hyperemia and periorbital pain. BC 48 was used in 21 patients with glaucomas of various kinds. The result of this medication was strikingly demonstrated in comparative charts. Eleven cases of chronic simple glaucoma showed good control of ocular tension. In secondary glaucoma (eight cases) the control was occasional and mostly unsatisfactory. The drug was ineffective in two patients with acute glaucoma.

BC 48 had been used previously by Git-

ler and Pillat. They used a 1 percent solution in their series of 53 cases of glaucoma. The results were about the same for the chronic simple and secondary glaucomas. The Viennese authors also could reduce the tension in four cases of acute glaucomas among ten. BC48 has an advantage over DFP in being soluble in water. It also can be easily checked by spectrophotography. It shares all the physiopathologic disadvantages with other less powerful drugs which act on the outflow mechanism and therefore are dependant on the amount of structural deterioration in the chamber angle. (9 figures, 1 reference)

Alice R. Deutsch.

Morone, G. **Enzymatic systems in the cornea.** Gior. ital. oftal. 10:102-111, March-April, 1957.

Bovine corneas preserved by drying and freezing retained, for periods varying from one to 100 days, the same quality and quantity of the two enzymes, cytochrome oxidase and dehydrogenase, while alkaline phosphatase was destroyed. (7 figures, 19 references)

V. Tabone.

Mueller-Stueler, Martin. **An incidence with Tosmilen.** Klin. Monatsbl. f. Augenh. 133:108-109, 1958.

One drop of this parasympathicomimetic drug precipitated a nearly lethal shock in a 64-year-old woman.

Frederick C. Blodi.

Münich, W. **The penetration of 3, 5-dioxo-1, 2-diphenyl-4-n-butyl-pyrazolidin (Butazolidin) into the human aqueous.** Arch. f. Ophth. 160:181-185, 1958.

In 28 patients the anterior chamber was emptied with an Amsler needle and Butazolidin was injected subconjunctivally; 14 hours later an aqueous sample was taken and analyzed. Practically no penetration of the drug was found in patients without anterior segment inflammation, but in patients with iridocyclitis an appreciable

amount was removed. (2 tables, 16 references)

Edward U. Murphy.

Noell, Werner K. **Differentiation, metabolic organization, and viability of the visual cell.** A.M.A. Arch. Ophth. 60:702-733, Oct., 1958.

The author reports experiments which attempt to explain the functional and metabolic organization of the mammalian visual cell in health and in disease and toxic conditions. (25 figures, 83 references)

G. S. Tyner.

Orlowski, W. J., Wekka, Z., Bartosiewicz, W. and Nowakowski, W. **Changes in the chemical composition of the aqueous under the influence of X rays. II. Protein and sugar levels.** Klinika Oczna 28: 11-18, 1958.

The authors investigated the protein and sugar level in the aqueous of rabbits. The average protein level was 125 mg. percent and sugar 114 mg. percent taken in 17 animals before the application of X rays. After irradiating the right eye of eight animals with 4000r no changes in the aqueous level of the sugar was found. The protein level was definitely increased one hour, 24 hours and even eight weeks after irradiation. Radiation damage to the cornea led to perforation of it in seven animals and to the atrophy of the eye in the remaining one. (1 figure, 5 tables, 21 references)

Sylvan Brandon.

Piper, H. F. **Limits of normal and subnormal visual performance.** Arch. f. Ophth. 160:131-143, 1958.

An analysis was made of simple light perception, gross orientation, and the higher epicritic sensations in individuals with various refractive errors and pathologic states. (14 figures, 23 references)

Edward U. Murphy.

Ruszkowski, Marian and Segal, Pawel. **Fractioning of lens proteins.** Klinika Oczna 28:5-10, 1958.

The authors examined the extracts from 18 human lenses by electrophoresis. Six of them were transparent and 12 were cataractous. Good patterns of soluble lens proteins were obtained. In the majority of cases patterns corresponded with that of the globulin fraction and were similar to the blood serum protein. The extracts from cataractous lenses produced undifferentiated patterns particularly where no albumin fraction could be found and, in contrast, transparent lenses produced distinct patterns containing globulin and albumin fractions. (3 figures, 11 references)

Sylvan Brandon.

Sabin, F. C. and Ogle, K. N. **Accommodation-convergence association.** A.M.A. Arch. Ophth. 59:324-332, March, 1958.

Previously reported studies have shown that cycloplegic drugs cause a marked increase in the accommodative convergence-accommodation rates. This study compares the effect of phenylephrine, which causes dilatation of the pupil without cyclopegia, and miotics which cause a small pupil and ciliary stimulation. Phenylephrine caused no change in the accommodative convergence. Pilocarpine and eserine also had no effect on accommodative convergence in 12 subjects. (4 figures, 12 references)

G. S. Tyner.

Sapuppe, Concetto. **Effect of aqueous on the anticoagulant action of aureomycin.** Gior. ital. oftal. 10:112-118, March-April, 1958.

The author, who had previously shown that the aqueous considerably hastened the coagulation time of blood, describes the results of a study to determine the effect of aqueous on blood treated with aureomycin. He found that the retarding action of aureomycin on blood coagulation was inhibited in vitro by the addition of aqueous. (13 references, 2 tables)

V. Tabone.

Sasamoto, Masahiro. **Studies on the central retinal pressure**, Jap. J. Ophth. 2:154-160, May, 1958.

The author has attempted a mathematical analysis of the pressures in the central retinal artery which parallel those of the brachial artery. The comparative differential pressure ratio decreases inversely to the severity of the hypertension or the resistance of the intracranial blood vessels. This is an aid to the Keith-Wagener classification of hypertensive disease. (3 figures, 9 tables, 5 references)

Irwin E. Gaynon.

Sbordone, G. **The content of sodium and potassium in the lens during the course of experimental ditizone diabetes**. Arch. di ottal. 62:73-75, Jan.-Feb., 1958.

Spectrophotometric tests on four rabbits showed an increase of sodium from 29 to 51 milligrams percent in 30 days. In the same time potassium decreased from 302 to 185 milligrams percent. (1 table, 4 references)

Paul W. Miles.

Suda, Makoto. **Incorporation of inorganic S³⁵ sulfate into sulfated mucopolysaccharides in the rabbit cornea**. Jap. J. Ophth. 2:172-176, May, 1958.

Electrophoretic and chromatographic studies show that the rabbit cornea may contain several types of sulfated mucopolysaccharides. (4 figures, 7 references)

Irwin E. Gaynon.

Tiberi, G. F. **The presence of a second break in the curve of dark adaptation of the retina**. Arch. di ottal. 62:19-25, Jan.-Feb., 1958.

Among 50 adaptation curves of normal eyes, 34 showed, in addition to the usual break at six minutes, a second break at 13.5 minutes. This has been reported previously, but needs further study. Three possible explanations are discussed. (1 figure, 5 references)

Paul W. Miles.

de Vincentiis, Mario. **Further observations on the chemical composition of subretinal fluid**. Arch. di ottal. 62:5-17, Jan.-Feb., 1958.

The composition of subretinal fluid obtained at operation for detached retina was compared to that of plasma and aqueous in the same individual. In ten cases, inorganic phosphorus was found to be 3.8 milligram percent in plasma compared to 1.0 in subretinal fluid. Ascorbic acid was found to be 1.2 mg. percent in plasma compared to 7.0 in subretinal fluid. In three subjects pyruvic acid was found to be 1.0 mg. percent in plasma, 4.0 in subretinal fluid, and 2.8 in aqueous. In three subjects lactic acid was 10 mg. percent in plasma, 46 in subretinal fluid, and 30 in aqueous. In three subjects ascorbic acid was 1.2 mg. percent in plasma, 7.0 in subretinal fluid, and 12 in aqueous. Glucose was 100 mg. percent in plasma, 70 in subretinal fluid, and 70 in aqueous. Bicarbonate showed little difference in the three fluids, about 120 mg. percent.

These results indicate that in detached retina the subretinal fluid has its origin from endocular fluids, not plasma. The relation of vitreous and the possibility of metabolic products from retinal pigment epithelium and reports from the literature on such substances as nitrogen compounds and enzymes in subretinal fluid are discussed. (2 tables, 43 references)

Paul W. Miles.

Wulff, V. J., Adams, R. G., Linschitz, H. and Kennedy, D. **The behavior of flash-illuminated rhodopsin in solution**. A.M.A. Arch. Ophth. 60:695-701, Oct., 1958.

Flash-illumination results in isomerization of the chromophore of rhodopsin, producing a mixture of retinene isomers bound to protein. The characteristics of these isomers are described. (6 figures, 11 references)

G. S. Tyner.

Zimmerman, L. E. and Johnson, F. B. **Calcium oxalate crystals within ocular**

tissues. A.M.A. Arch. Ophth. 60:372-383, Sept., 1958.

The authors have found calcium oxalate crystals in the nuclei of Morgagnian cataracts and in the outer layers of retinas that have been detached for a long time. (8 figures, 4 tables, 20 references)

G. S. Tyner.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Bagolini, B. **Examination of binocular vision by means of a striated glass.** Boll. d'ocul. 37:195-209, March, 1958.

The author feels that the "test of the striated glass" is more accurate than similar tests with Wirth dots, the red glass, or the synoptophore. The test avoids the suppression or dissociating effects of the tests themselves and more accurately approaches the real condition of the eyes at rest. (3 figures, 10 references)

Joseph E. Alfano.

Boynton, Robert M. **On-responses in the human visual system as inferred from psychophysical studies of rapid-adaptation.** A.M.A. Arch. Ophth. 60:800-810, Oct., 1958.

The author reports his investigation of the transition from the absolute cone threshold on the one hand, to the luminance-discrimination threshold on the other. He makes a plea for the importance of psychophysical procedures as clinical tools and experimental data. (6 figures, 16 references)

G. S. Tyner.

Brenner, I. **A simple device to determine the angle of corneal astigmatism.** A.M.A. Arch. Ophth. 60:504-505, Sept., 1958.

The device consists of an opaque disc which may be rotated in the cell of the trial frame. It has a slit 2 to 3 mm. wide and a pointer. It is used in conjunction

with a plain mirror as is usual in skiascopic examination. (1 figure)

G. S. Tyner.

Damiani, A. **Ametropia in children of school age.** Gior. ital. oftal. 10:147-162, March-April, 1957.

The author describes the results of a clinico-statistical study of ametropias among 5,600 children of school age. The results were classified according to age, to the different classes, to sex, and to economic conditions of the subjects. The relation between strabismus and errors of refraction was also noted. (8 tables, 48 references)

V. Tabone.

Ehrlich, Wulf. **Methods for an entoptic examination of visual functions.** Klin. Monatsbl. f. Augenh. 133:396-401, 1958.

In the dark-room the illumination is applied diasclerally to the lower temporal segment. A small but intensive light source (Euthyscope) is used and moved equatorially on the sclera. The patient looks against a gray wall and evaluates his macular pattern. One eye is tested against the other. (4 figures, 21 references)

Frederick C. Blodi.

Foster, John. **Pleoptics.** Tr. Ophth. Soc. U. Kingdom 77:645-651, 1957.

Pleoptics is a word introduced by Bangerter's book to include all forms of amblyopia and its sensory and psychologic treatment. In its management one uses the Visuskop, an ophthalmoscope which projects a star on the retina (50 percent of all amblyopes could be shown to fix eccentrically). One asks the patient to fix it, then rotates a further disc projecting a grid, which allows the direct measurements. The euthyscope, an ophthalmoscope with a specially wide angle of projection (30°), has a powerful light with a lens system to focus a 5° spot on the macula under direct vision. After treatment one can recognize the existence

of visual agnosia as a symptom distinct from visual failure and mental defect. (2 tables, 15 references)

Beulah Cushman.

Gernet, H. **A measurable, partial occlusion with polaroid glasses for the treatment of amblyopia and strabismus.** *Klin. Monatsbl. f. Augenh.* 133:388-396, 1958.

Two filters are used in front of the better eye. One is fixed, the other can be rotated. By rotating the second filter the visual acuity of a normal eye can be reduced anywhere from 5/4 to 5/50. If such a lens is prescribed for a specific patient both filters are immobile, but rotated against each other to a desired degree. (3 figures, 14 references)

Frederick C. Blodi.

Görtz, Heinz. **Comparative investigations of binocular vision at the apparatus and in free space.** *Klin. Monatsbl. f. Augenh.* 133:402-407, 1958.

Normal binocular vision at the synoptophor does not necessarily mean that the patient uses this function in free space; 90 successfully treated patients are analyzed. Even if the visual axes are practically parallel only three-fourths of the patients with binocular vision at the synoptophor will have binocular vision in free space. (4 tables, 4 references)

Frederick C. Blodi.

Görtz, Heinz. **Fractional changes in correspondence.** *Arch. f. Ophth.* 160:164-170, 1958.

Instead of trying to overcome an abnormal retinal correspondence in one step, the author recommends a gradual lessening of the angle of anomaly in a series of steps. (1 table, 5 references)

Edward U. Murphy.

Graham, C. H. and Hsia, Y. **Color blindness and color theory.** *A.M.A. Arch. Ophth.* 60:792-799, Oct., 1958.

Results are given from the examination of protanopes, deuteranopes, and normal subjects. Protanopes show a loss of luminosity in the red while deuteranopes are found to show a loss of luminosity in the green and blue.

Experiments on a young woman whose right eye had normal color vision and whose left was dichromatic are reported. (7 figures, 14 references) G. S. Tyner.

Kent, N. D. and Schlaegel, T. F., Jr. **Selective perception and autonomic response in hysterical amblyopia.** *A.M.A. Arch. Ophth.* 60:450-454, Sept., 1958.

The fact that persons may respond to visual stimuli even though they are unable to verbalize awareness is referred to as subception. It has been observed that even though a stimulus is exposed for such a brief time that subjects are unable to verbalize recognition, they are able to give responses as measured by the galvanic skin response. Using a Dodge-type tachistoscope while the galvanic skin response was being continuously recorded, the authors found that there was no evidence for a subception process in either the group with tubular fields or in the control groups. However, all patients with tubular fields showed greater autonomic reactivity to all stimuli than the control groups. (2 tables, 4 references)

G. S. Tyner.

Montauffier, Riu, Camo and Hebert. **Color vision in the Navy.** *Ann. d'ocul.* 191:420-457, June, 1958.

The authors cite two marine disasters that were probably caused by misinterpretation of colored signal lights. Because of this they have analyzed the qualities necessary to make navigational lights readily visible and in the second part of their article they discuss the effect of various dyschromatopsias on color signal perception.

They state that red lights should have

a wave length between 625 and 640 m μ , and green between 490 and 510 m μ . The luminance should be defined as that of color temperature 2848 degrees K.

A group of 517 young men were then examined of whom 93 percent were found to be normal trichromats. The Nagel anomaloscope was used to further classify the dyschromats (7 percent). These were divided into anomalous trichromats and dichromats. The authors conclude that the latter group and protanomalous trichromats are unsuitable for perception of colored signals. As for the deuteranomalous trichromats the authors finds that the only reliable test is the use of colored signal lights. Pseudo-isochromatic tables, the anomaloscope and the Farnsworth D-15 test were found to be unreliable. (1 figure, 6 tables, 55 references)

David Shoch.

Nadbath, Rudolph P. **The rule of seven or fourteen thirds.** A.M.A. Arch. Ophth. 60:534-536, Oct., 1958.

Nadbath describes his "Rule of 7 or 14 Thirds" in using the ophthalmometer in refraction. (1 table, 2 references)

G. S. Tyner.

Ogle, Kenneth N. **Present status of our knowledge of stereoscopic vision.** A.M.A. Arch. Ophth. 60:755-774, Oct., 1958.

The theories of production and the factors involved in stereoscopic vision are discussed. (11 figures, 43 references)

G. S. Tyner.

Reinecke, R. D. and Cogan, D. G. **Standardization of objective visual acuity measurements.** A.M.A. Arch. Ophth. 60:418-421, Sept., 1958.

The authors have compared the objective visual acuity as measured by the optokinetic reflex with the subjective Snellen visual acuity and find that they are well correlated. (2 figures, 9 references)

G. S. Tyner.

Schober, Herbert. **Television spectacles.** Klin. Monatsbl. f. Augenh. 133:383-387, 1958.

Such spectacles should absorb 25 to 35 percent of the light. They should have a slight yellowish hue, but no part of the visible spectrum, especially the blue component, should be cut off. (1 figure, 7 references)

Frederick C. Blodi.

Volckmar, H. and Willomitzer, H. **Refraction with the short-lasting mydriatic "Roche."** Klin. Monatsbl. f. Augenh. 133:412-415, 1958.

This new drug was tried for refractions in 200 patients. The paresis of accommodation corresponded to that of a 2-percent homatropine solution. The pupil was nearly normal in size after six hours. (5 tables)

Frederick C. Blodi.

5

DIAGNOSIS AND THERAPY

Aguilar Bartolome, Jose M. **The clinical results of phosphoryl choline chloride in hypotony.** Arch. Soc. oftal. hispano-am. 18:451-455, May, 1958.

The author reports nine cases of ocular hypotony, resistant to all therapy, treated with this agent with good results. Four cases were of retinal detachment, which had been subjected to several unsuccessful surgical procedures; three were post-operative cataract cases, and two were of traumatic origin. As the histories show that phosphoryl choline chloride is a very effective agent in cases of surgical hypotony, particularly in those following cataract extraction. It is also effective in traumatic and post-inflammatory hypotony. It is less, although still appreciably, effective in hypotony following retinal detachment. It has no effect on hypotony following fistulating operations. The drug is used subconjunctivally and by instillation. (4 references)

Ray K. Daily.

Altenberger, Stanislaw. **The removal of intraocular magnetic foreign bodies.** Klinika Oczna 28:19-24, 1958.

Interaction of forces between the magnetic foreign body and the magnet is explained. X-ray localization is mandatory unless the foreign body is visible directly. The anterior route of extraction is used when the foreign body is in the anterior chamber, the lens or the posterior chamber. When the posterior route is used for a foreign body in the vitreous, retina or choroid, a magnetic test is performed before the incision of the sclera. The giant magnet is brought as close to the foreign body as possible. In case of a magnetic body the sclera bulges up. The author prefers not to incise the choroid, but rather to let the foreign body push through it. (7 references)

Sylvan Brandon.

Barthelmess, G. A **mobile operating table for ophthalmic surgery.** Klin. Monatsbl. f. Augenh. 133:95-97, 1958.

The table is simple and convenient. The patient can easily be lifted into his bed. (2 figures)

Frederick C. Blodi.

Belmonte Gonzales, Nicholas. **Clinical ophthalmodynamometry.** Arch. Soc. oftal. hispano-am. 18:473-807, June-July, 1958.

This comprehensive monograph begins with a review of the development of dynamometry, from its inception to the present day. The literature comprising 256 publications is reviewed critically and in detail. The clinical value of dynamometry is assessed in cases of cranial hypertension, in lesions of the carotid or its branches, in headaches, and in general vascular hypertension of various etiology. The author's personal investigations in this field consist of a study of 1,181 cases which are reported graphically and in detail. The cases are grouped according to clinical lesions. The correlation between

the median pressure in the central retinal artery and the brachial artery was calculated for each group, using the conversion tables of Bailliart and Magitot, and those of Muller-Bruning-Sohr. The data obtained differed but little from those of Bailliart and Weigelin. The author concludes that the measure of the pressure in the central retinal artery is valid for the determination of whether the vascular circulation in the region of the internal carotid is within the range of normal or is disturbed; dynamometry does not provide information as to the state of the intraocular circulation. It leads to the diagnosis of localized changes in the internal carotid or its branches, and in the differentiation of vasomotor headaches. From the cerebrovascular resistance it determines the state of the cerebral circulation which is not always in accord with the general circulation, the anatomic fundus changes, or the brachial pressure. Because of the numerous sources of error, the author recommends that ophthalmodynamometers should first be used on a series of normal cases, before relying on conclusions based on data derived from them.

Ray K. Daily.

Biró, I. **The eyeground in young patients with hypertension.** Klin. Monatsbl. f. Augenh. 133:227-237, 1958.

Among 10,000 young athletes 831 had a blood pressure higher than 140/90. None of the athletes was older than 30 years. Among the first ocular signs are stretching of the arterioles and abnormalities at the arterio-venous crossings. (3 figures, 8 references)

Frederick C. Blodi.

Donaldson, David D. **A binocular indirect ophthalmoscope with upright fundus image.** A.M.A. Arch. Ophth. 60:499-501, Sept., 1958.

In order to avoid the problem of the inverted image in indirect ophthalmos-

copy, the author has devised a modification that produces an upright image. (4 figures)

G. S. Tyner.

Dunnington, J. H. and Regan, E. F. **Some modern concepts of ocular wound healing.** A.M.A. Arch. Ophth. 59:315-323, March, 1958.

In the twentieth de Schweinitz lecture, the author discusses the roles of epithelium, corneal stroma, endothelium and Descemet's membrane in wound healing. The pathogenesis of epithelial invasion of the anterior chamber is discussed. Factors which invite epithelial invasion are wound fistulae, incarceration of iris tissue, and too deeply placed sutures. There is some evidence to suggest that epithelium invades along silk sutures but not along mild chromic sutures. The treatment of epithelial invasion is surgical and is based upon thorough cauterization and curettement of the invading cells followed by firm wound closure. Since the iris usually provides nourishment to the invading cells, broad iridectomy in the affected area is an extremely important part of the treatment. (36 references)

G. S. Tyner.

Farina, R., Cavalheiro, J., Braga, P., de Toledo, P. and Renata, E. **Plastic repair of congenital and acquired deformities in ophthalmology.** Rev. brasil. de oftal. 17:335-343, Sept., 1958.

The authors tabulate the different congenital and acquired deformities of the lids, which can be corrected by means of plastic surgery. They illustrate their paper with some photographs of patients before and after surgery and emphasize the importance of good primary repair after injury. (9 figures, 6 references)

Walter Mayer.

Filipović, Albert. **The prevention of acute disseminate cataract after zinc cauterization.** Klin. Monatsbl. f. Augenh.

133:268-269, 1958.

The author observed the development of this type of cataract in three patients with dendritic keratitis who had been cauterized with a 20-percent zinc sulfate solution. In the next three patients with herpes a 10 percent solution was used and no cataract developed. (10 references)

Frederick C. Blodi.

Franceschetti, A. and Canossa, A. **A new instrument for taking lamellar grafts.** Tr. Ophth. Soc. U. Kingdom 77:109-113, 1957.

The technique for obtaining a disc of regular thickness is important, and the authors have devised a new apparatus with different stands and rings to permit grafts of variable diameter to be obtained. The cornea must be flattened in order to obtain a graft of regular thickness. (15 references)

Beulah Cushman.

François, J., Rabaey, M. and Lagasse, A. **Histo-radiography of ocular tissues.** Ann. d'ocul. 191:500-506, July, 1958.

Routine sections of eyes 6 to 10 μ thick are placed in a 1 percent solution of osmium tetroxide for 10 to 30 minutes. They are then placed on a photographic film and exposed to X-rays. The authors describe the cornea, ciliary body and optic nerve as revealed by this technique. Structures such as the corneal parenchyma which are less permeable to X-rays than such structures as the epithelium and Descemet's membrane are well seen. The authors hope to make use of this technique to define the microstructure of the trabeculum. (5 figures)

David Shoch.

Friede, R. **An operation for incurable facial palsy.** Klin. Monatsbl. f. Augenh. 133:559-562, 1958.

The author has modified Burian's method. A subcutaneous suture (thick catgut or silk) is carried along the lower

lid, inner canthus, above the brow and outer canthus. It is repeatedly brought out through the skin. When the suture is pulled tight the lower lid is lifted. The same method can be used about the mouth. (2 figures) Frederick C. Blodi.

Fuchs, J. **An improved method for the diascleral illumination of suspicious lesions at the posterior pole.** *Klin. Monatsbl. f. Augenh.* 133:487-493, 1958.

This small lamp is attached to a long, flexible, metal tube which can be sterilized. Conjunctiva and Tenon's capsule must be opened and then this light-probe is pushed backward. It is not necessary to resect a muscle. This method was used 10 times during the last five years. Four patients are described in detail. (5 figures, 4 references) Frederick C. Blodi.

Gaud, F. **Ocular complications of infectious eruptive diseases of childhood.** *Arch. d'opht.* 18:25-56, 1958.

In a comprehensive survey of the subject the author has considered in detail the ocular complications of the infectious eruptive diseases, mainly of viral origin, in childhood. In a consideration of measles he notes the punctate epithelial keratitis, the Koplik spots, and the rare instances of interstitial keratitis. In a consideration of German measles he mentions the conjunctival hyperemia, transient epithelial keratitis, and occasional uveomeningitic-encephalitic complications, largely oculomotor. Other diseases considered include varicella, vaccinia, variola, and scarlet fever. A color plate illustrates well the corneal complications of varicella. An extensive bibliography is appended. (5 figures, 85 references)

P. Thygeson.

Glees, M. **The value of directly enlarged X-ray pictures in ophthalmic diagnosis.** *Klin. Monatsbl. f. Augenh.* 133:552-559, 1958.

Enlarged pictures can be obtained with tubes of unusually fine focus (diameter less than 0.3 mm) by widening the object-film distance. With this arrangement a twofold enlargement can be used. Six patients are described in whom this method was of value; in three a small foreign body became visible. In the other three patients changes in the optic foramen could be noted. (12 figures, 1 table, 7 references) Frederick C. Blodi.

Goodstein, S. and Goeller, J. **A simplified method of stereophotography of the eye.** *A.M.A. Arch. Opth.* 60:630-631, Oct., 1958.

The author describes his apparatus. (3 figures, 2 references) G. S. Tyner.

Gunter, R., Dewig, E. and Mills, K. S. **Some effects of diathermy currents on eye tissue.** *A.M.A. Arch. Opth.* 60:437-442, Sept., 1958.

In retinal detachment operations by high-frequency current, the surgeon has no exact measurement of the amount of current. The authors suggest a minimal measuring system. They state that the impedance of the tissues decreases with the passage of current during treatment and with the lowering of anesthetic level. (3 figures, 2 tables, 3 references)

G. S. Tyner.

Hudelo, A. and Maussion, L. **Senile capillaritis and calcium ionization.** *Ann. d'ocul.* 191:411-419, June, 1958.

The authors report a variety of diseases of the eye in which "calcium ionization" was employed. The technique of administration is not given except for the statement that the choice of technique is left to the discretion of the "electrologist." They find that only in cases of senile macular capillaritis is there any value to this treatment and that in this group age is no contraindication to therapy. (1 table) David Shoch.

Juette, A. **Experiences with the electrocautery of Passow.** *Klin. Monatsbl. f. Augenh.* 133:572-575, 1958.

The fine tip is used at a temperature of 95° to 120° Centigrade for up to two minutes. It was used in 11 patients with herpes simplex, in 18 patients with a corneal ulcer and in six patients with a ser-piginous ulcer. The results were excellent and the cautery improved the effects of antibiotics and sulfonamides. (3 tables, 7 references) Frederick C. Blodi.

Karliner, William. **Electroshock therapy in the presence of retinal detachment.** *Dis. Nerv. System* 19:401, Sept., 1958.

No harm resulted from shock therapy given to two patients with retinal detachment. Irwin E. Gaynon.

Lieb, W. A. and Geeraets, W. J. **The use of plastic material in ophthalmic surgery.** *Klin. Monatsbl. f. Augenh.* 133:305-342, 1958.

This is a review article which starts with a historical note. Thiel was the first to use a plastic in 1939 which he put into the orbit after an enucleation. The tolerance to a variety of such polymers was tested by putting a piece of the material into the anterior chamber of animals' eyes. Acrylic, Supramid and Teflon precipitated the least reactions. In a second series of experiments only those plastic materials were tested which had optical qualities suitable for an anterior chamber lens. Here, Lucite and Silicone B 695-106-1 were best tolerated.

Various applications are then described. For ptosis, orbital repair, dacryocystorhinostomy, orbital implants, retinal detachment and glaucoma operations, plastic material has been used. Anterior chamber lenses of plastic have also been tried. (31 figures, 127 references)

Frederick C. Blodi.

Lowenstein, O. and Loewenfeld, I. E. **Electronic pupillography.** *A.M.A. Arch. Ophth.* 59:352-363, March, 1958.

The authors describe the instrument and some clinical applications. The purpose of clinical pupillography is the detection and localization of pathologic processes within the nervous system and pathways of pupillary control. A schematic illustration is included with a description of the types of lesions which can be studied. Details of the instrument are included. (11 figures, 25 references)

G. S. Tyner.

Marx, J. and Willomitzer, H. **Chemotherapy of palpebral epitheliomas with "Bayer E 39."** *Klin. Monatsbl. f. Augenh.* 133:535-543, 1958.

The new drug has cytostatic properties. As an antimetabolite it inhibits mitoses. As a first injection 5 mg. are given. The drug is dissolved in absolute alcohol and injected directly into the tumor. The injection must usually be repeated several times, in an interval of four days. Thirteen patients with basal-cell epithelioma were successfully treated. The macroscopic improvement is spectacular. Histologic examination of the resulting scar tissue may reveal a few strands of viable tumor cells. (19 figures, 1 table, 8 references).

Frederick C. Blodi.

McDonald, J. E. and Light, A. **Photocoagulation of iris and retina.** *A.M.A. Arch. Ophth.* 60:384-392, Sept., 1958.

A machine is described which can cause photocoagulation of the iris and retina of rabbits. In about one third of the cases a hole developed in the iris. Photocoagulation of the retina was accomplished with an exposure of two or three seconds without production of cataracts. (11 figures, 15 references)

G. S. Tyner.

Meyer-Schwickerath, G. **Further progress in the field of light coagulation.** Tr. Ophth. Soc. U. Kingdom 77:421-440, 1957.

The author used an instrument developed in 1949 after three years of experimentation with the sun as the source of visible light. Light coagulation succeeds with a light source which gives high radiation density in the visible region of the spectrum between 350 and 900 millimicrons. In the eye the following conditions must be present, fairly clear refractive media and a fairly dark color of tissue to be coagulated.

The coagulation of a macular hole after looking at a solar eclipse is successful when the retina is not separated too far from the light absorbing layers (between one and two diopters separation). Prophylactic light coagulation of peripheral retinal regions is of use in eyes which have undergone degenerative changes which may lead to hole formation and in patients who have lost one eye through detachment of the retina, as happens in Marfan's syndrome and before removal of a dislocated lens. A combination of light coagulation with surgical operation is indicated in patients in whom the operation is hindered by a vortex vein. Light coagulation may be beneficial after perforating injuries of the sclera and around the foreign body before it is removed. Diathermal coagulation in periphlebitis has prevented vitreous hemorrhages up to two and one-half years.

Light coagulation is useful before enucleation for melanosarcoma. Carcinomatous metastases have been coagulated and hemangiomas of the choroid should be treated with light coagulation. Angioma-tosis retinae provides the most satisfactory field among intraocular tumors but the large vessels should not be destroyed too quickly. Fresh gliomas are fairly transparent and the choroid can be coagu-

lated after examination for other nodules in two to four weeks. Tumors more than five diopters high could not be delimited. (7 figures) Beulah Cushman.

Mishima, Saiichi. **The biomicroscopy of the human eye using polarized light: Findings in the normal cornea.** Jap. J. Ophth. 2:182,192, Aug., 1958.

Biomicroscopic examination of the cornea with polarized light reveals the dark cross to be composed of multiple hyperbolic figures which appear as a dark gap in the optical section and are related to the radial fibers which are in the deeper layers of the cornea. The multi-layered color bands which appear to lie on the iris are attributed to interference phenomena due to double refraction of rays passing through the cornea.

The fibers in the superficial layers of the cornea intersect one another throughout; in the deep layers of the cornea the fibers intersect one another in the peripheral portion of the cornea and assume a radial configuration in the medial portion. (8 figures, 8 references)

Irwin E. Gaynon.

Norton, H. J. and Sullivan, C. T. **Practical dual-exposure stereophotography of the retina.** A.M.A. Arch. Ophth. 60:455-460, Sept., 1958.

Ideas and methods are advanced to improve retinal photographic results. The authors discuss the practical usefulness of this type of photography when applied to the retina. The use of controlled quantitative technique is emphasized. The authors believe that the application of the concepts which they elaborate will greatly improve retinal photography when used with refined optical-illuminating systems of modern retinal cameras. (4 figures, 13 references) G. S. Tyner.

Remky, H. **Clinical observations on serologically diagnosed ocular tubercu-**

losis. *Klin. Monatsbl. f. Augenh.* 133:519-529, 1958.

The hemagglutination test of Middlebrook-Dubos is performed on serum and aqueous. The titer of the test is correlated with the globulin content of the fluid. The titer is expressed per 1000 mg. per cent α globuline. If this relative value is higher in the aqueous than in the serum the antibodies are produced locally in the eye.

Ten cases of uveitis are described in which the relative antibody titer in the aqueous was at least twice as high as that titer in the serum. These ten patients were found among 92 with uveitis during a period of 10 months. Nine of these patients had an anterior uveitis (one with periphlebitis), the tenth had a panuveitis. (5 figures, 2 tables, 11 references)

Frederick C. Blodi.

Roper-Hall, M. J. **An intraocular foreign body locator.** *Tr. Ophth. Soc. U. Kingdom* 77:239-250, 1957.

The author discusses the development of an electronic foreign body detector which aids in locating nonmagnetic as well as magnetic particles and gives an indication of their chemical and physical properties after accurate localization. (4 figures, 7 references) Beulah Cushman.

Rudobielski Romuald. **Leukergy in inflammatory diseases of the eye.** *Klinika Oczna* 28:25-30, 1958.

The phenomenon of agglutination of leukocytes in inflammatory conditions is utilized for diagnostic purposes. Seventy-eight patients were tested. One group of 35 patients, without any inflammatory eye diseases was used as controls. In 10 of them more than 5 per cent of the leukocytes were agglutinated. In the second group of 22 persons, mostly with choroidal changes and also pulmonary lesions, 10 patients had more than 5 per cent agglutination. In the third group of 21 patients, choroidal changes were pres-

ent with focal infection of teeth or tonsils and 14 patients had agglutination above 5 percent. For differentiation of a tuberculous etiology a tuberculin test was given in suspected cases and 72 hours later the blood was checked for leukergy. In positive cases leukergy was definitely increased. In negative cases successful treatment with typhoid vaccine proved the presence of focal infection as the source of trouble. (20 references)

Sylvan Brandon.

Schippmann, Hermann. **Our experiences with antihistamine therapy in ophthalmology.** *Klin. Monatsbl. f. Augenh.* 133:409-412, 1958.

Two drugs were used (Thiantan and AH 3). In six out of 14 patients with choroiditis an improvement was noted. In external allergies and phlyctenular inflammations the drugs were especially helpful. (9 references)

Frederick C. Blodi.

Tavares, A. L. **Recent developments in ocular anti-allergic therapy.** *Arq. brasil. de oftal.* 21:26-71, 1958.

The author reviews the theories of Selye and the "alarm reaction" and those of Reilly, who feels that allergy is characterized by a disturbed equilibrium of the vegetative nervous system with an associated production of chemical mediators, trophic reactions in the organism and an endocrine stimulation by an "aggressor." These ideas are reconciled when one considers allergy as a disease of adaptation in which the antigen stimulates production of antibodies by way of the reticuloendothelial system. The antigen-antibody reaction results in the secretion of ACTH with subsequent endocrine and metabolic changes. The author considers the ocular manifestations of allergy to be reactions of alarm and the eye and adnexa as shock organs. In general, the most common ocular reactions

of hypersensitivity are: 1. anaphylactic, due to protein sensitization, 2. allergic ocular reactions due to sensitization and intoxication by bacterial antigens, and 3. focal reactions, seen in experimental ocular tuberculosis. The reaction may be immediate (protein) or delayed (bacterial).

Antihistamines have been administered locally and systemically in treating various ocular manifestations of allergy. The rationale is predicated upon the theory of neutralizing histamine, liberated during the antigen-antibody reaction. Their effectiveness varied with the type of disease, dosage and mode of administration, and left much to be desired. Probably the greatest advance in this field of therapy has been the use of the corticosteroids. It is stressed, however, that neither the steroids nor antihistamines are curative. The only therapy which offers a cure is desensitization. This may be specific against a certain allergen, or nonspecific when the offending agent cannot be identified with any degree of certainty. Bacterial vaccines, typhoid vaccine, peptones, and auto-hemotherapy are examples of nonspecific therapy. The role of allergy in tissue transplants and allied surgical procedures deserves further investigation, as does the effect of several antihistamines upon glaucoma. (70 references)

James W. Brennan.

Tóth, Z. **What can be seen with the ophthalmoscope in hypertensive patients?** Klin. Monatsbl. f. Augenh. 133:368-376, 1958.

The author speculates on the importance of vascular tortuosity, A-V nicking and angle of bifurcation. (8 figures, 10 references)

Frederick C. Blodi.

Trevor-Roper, P. D. **Hypothermia in hamsters.** Tr. Ophth. Soc. U. Kingdom 77:401-415, 1957.

Hypothermia provides a means of storing isolated cells and tissues. The cornea can be stored at -79° for months and then used as a transplant. (13 figures, 15 references)

Beulah Cushman.

6

OCULAR MOTILITY

Bagolini, B. and Rizzo, P. **Diagnosis and prevention of postoperative diplopia following strabismus surgery.** Boll. d'ocul. 37:345-364, May, 1958.

The authors feel that by means of prisms and a filter bar with filters of progressive density, it is possible to estimate the extent of an area of suppression and the intensity of the suppression at different points in this area. On the basis of these observations they feel that they can predict which patients will have postoperative diplopia. They feel that this diplopia may be avoided by correcting the strabismus only up to the point where the second image will fall within the area of suppression. (1 table, 19 references)

Joseph E. Alfano.

Colombi, Carlo. **Fusion for distance in anomalies of binocular vision, before and after treatment.** Rassegna ital. d'ottal. 27: 204-207, May-June, 1958.

The author reviews a series of cases of strabismus in which orthoptic training had been given. All patients were improved, although some only after surgery had been employed; all had parallelism or slight deviation of the visual axes and 37 had fusion for distance. (1 table, 6 references)

Eugene M. Blake.

Hollwich, F. **Ocular pareses in the status dysraphicus.** Klin. Monatsbl. f. Augenh. 133:465-471, 1958.

Status dysraphicus is a congenital, stationary anomaly of the spinal cord which leads to multiple defects in areas innervated by the sympathetic system. The lesions in the cord consist of small cysts

and gliosis comparable to a microform of syringomyelia. Horner's syndrome and heterochromia of the irides are the most frequent ocular signs in status dysraphicus (Passow).

The author describes three patients with a sixth and three patients with a seventh nerve palsy. These palsies were congenital or acquired in early childhood. (1 table, 8 references)

Frederick C. Blodi.

Johnstone, I. Lloyd. **The operative treatment of abducens palsy.** Tr. Ophth. Soc. U. Kingdom 77:629-637, 1957.

Among 21 patients operated upon since early 1941 the abducens palsy was congenital in 13 and traumatic in five. Results were considered good when the visual axes were parallel in the primary position. This occurred in eight patients. Nine patients were improved in that a satisfactory cosmetic result was achieved with no diplopia in the primary position.

After injury spontaneous recovery usually took place within six to 12 months. (6 figures, 2 tables, 7 references)

Beulah Cushman.

Parry, Rupert. **An investigation into the long-term end-results of concomitant strabismus.** Tr. Ophth. Soc. U. Kingdom 77:393-400, 1957.

The investigation was planned to cover 500 operative and non-operative cases; in only 49 was the treatment both operative and non-operative. All patients had preliminary orthoptic investigation and the status in the immediate post-operative period showed no changes ten years later.

The author discusses the theories of strabismus and treatment of the different types. Those called "accommodative squints" needed no surgery and responded to orthoptic treatment if the deviation was less than 20 degrees, and if glasses found necessary were ordered early.

Beulah Cushman.

7

CONJUNCTIVA, CORNEA, SCLERA

Buchmann, H. H. and Frank, W. **Lime burns treated with an early operation.** Klin. Monatsbl. f. Augenh. 133:494-499, 1958.

In 31 patients with chemical burns the eyes were treated by an early operation according to Passow. This operation consists of multiple incisions into the damaged conjunctiva which allows the toxic edema to escape and improves vascularization. Eight patients were injured with an acid, three with molten iron and 20 with lime. The results, as far as vision and duration of hospitalization are concerned, compare favorably with an earlier series of chemical burns in which the eye was not operated upon. The importance of operating as early as possible even in mild cases is stressed. (4 tables, 13 references)

Frederick C. Blodi.

Chinaglia, V. and Amidei, B. **Disciform hematic infiltration of the cornea.** Rassegna ital. d'ottol. 27:169-191, May-June, 1958.

The author reports cases of hematic disciform infiltration of the cornea, one occurring in a ten-year-old girl and the other following an iridectomy for acute glaucoma. The subject of blood staining of the cornea and its etiology and pathogenesis is well reviewed. The question arises as to whether one is to regard the picture described as due to blood impregnation by diffusion and imbibition in the parenchyma, or whether it is a true intracorneal hematoma. (6 figures, 22 references)

Eugene M. Blake.

Eguchi, Koichiro. **Studies on keratitis superficialis diffusa: the riboflavin metabolism in 30 cases.** Jap. J. Ophth. 2: 226-235, Aug., 1958.

The patients who have keratitis superficialis diffusa with normal lacrimation have an abnormal riboflavin metabolism

and respond to riboflavin therapy. The patients with deficient lacrimation have normal riboflavin metabolism, show no response to riboflavin therapy and are most likely to develop keratoconjunctivitis sicca early. (10 figures, 3 tables, 7 references) Irwin E. Gaynon.

Jones, Barrie R. **Lacrimal and salivary precipitating antibodies in Sjögren's syndrome.** *Lancet* 2:773-776, Oct. 11, 1958.

Lysozyme is absent or markedly reduced in the tears in keratoconjunctivitis sicca. The agar-gel diffusion precipitin test demonstrated antibodies to extracts of lacrimal and salivary glands from cadavers in one patient out of 40 with Sjögren's syndrome. These may be specific autoantibodies. (3 figures, 1 table, 17 references) Irwin E. Gaynon.

Jones, B. R., Andrews, B. E., Henderson, W. G. and Schofield, P. B. **The pattern of conjunctivitis at Moorfields during 1956.** *Tr. Ophth. Soc. U. Kingdom* 77:291-305, 1957.

The author reviews the relative place of the many new viruses and the new group of adenoviruses and other viruses among the classic bacterial pathogens. Patients with acute conjunctivitis seen within five days of onset were studied. Bacterial cultures were taken in blood agar, and conjunctival swabs for virus isolation were stored in broth. (2 figures, 9 tables, 8 references)

Beulah Cushman.

Oguchi, Masami. **Allergic reactions of skin and conjunctiva with pollen in vernal catarrh.** *Jap. J. Ophth.* 2:207-213, Aug., 1958.

In an experiment conducted during the winter time, the pollen of the anemophilus flowers was instilled into the conjunctival sac of patients who had a positive skin reaction to the same pollen and to some whose skin reaction was negative and

who did not have vernal catarrh. In 50 percent of the patients there was a recurrence of symptoms. The findings of vernal catarrh also occurred in three out of eight patients who had a positive skin reaction, but no conjunctival symptoms. (2 tables, 7 references)

Irwin E. Gaynon.

Schenk, H. **Corneal findings in idiopathic anesthesia of the cornea.** *Klin. Monatsbl. f. Augenh.* 133:506-518, 1958.

Within a period of 12 years 11 patients with an idiopathic anesthesia of the cornea were observed. In six of the patients the condition was bilateral. Most of the patients were of advanced age. It occurred spontaneously in nine patients and after a cataract extraction in two patients. The cornea showed at least a superficial, punctuate keratitis, but central or limbal ulcers developed frequently. This group of patients is compared with six patients who had an anesthesia of the cornea secondary to a central or peripheral lesion of the trigeminal nerve. (1 figure, 1 table, 17 references) Frederick C. Blodi.

Smelser, George K. **The anatomical and physiological aspects of corneal surgery.** *New York Acad. Med. Bull.* 34:641-648, Oct., 1958.

The cells, fibers and ground substance take part in corneal healing. About fifty percent of the mucopolysaccharides of the normal cornea are destroyed and replaced every 32 days. The normal cornea is always being renewed. After a corneal incision, the damaged tissue releases proteolytic enzymes, the monocytes and keratocytes metamorphose into fibroblasts, from the surface of which fine reticular cells are spun out. The first fibers formed are reticular and have an heterogenous arrangement. As the wound is strengthened, the stress and tension of the intraocular pressure plays a part in the replacement by fibers that are parallel

to the surface of the cornea, equal in diameter, and very fine. The ground substance is synthesized at a much higher rate than in the normal cornea. Hence, wound healing takes a long time during which synthesis and destruction of the elements of scar formation are followed by resynthesis of the corneal structure. (1 figure, 17 references)

Irwin E. Gaynon.

Thier, Adolf. **Electrocautery of infectious corneal diseases.** *Klin. Monatsbl. f. Augenh.* 133:575-578, 1958.

Two patients with a recurrent corneal ulcer were successfully treated. (1 reference)

Frederic C. Blodi.

Thygeson, Phillips. **The present status of laboratory research in trachoma.** *Bull. Wld. Hlth. Org.* 19:129-152, 1958.

The author presents a comprehensive description of the nature and properties of the trachoma virus, the pathologic changes which it produces, and its relationship to the virus of inclusion conjunctivitis. The methods of making a laboratory diagnosis are described.

The present status of laboratory research and special studies relating to this disease are summarized. This research has been hindered both by the lack of a suitable laboratory animal and by the failure of tissue-culture methods to provide serial cultures of the virus. Some suggested avenues for future investigation are given. (103 references)

William S. Hagler.

Valière-Vialeix, H. and Robin, A. **Surgical treatment of pterygium by a free graft of the conjunctiva.** *Ann. d'ocul.* 191:507-513, July, 1958.

The authors feel that a pterygium is a response of the limbal vessels to a metabolic defect of the cornea, and not a primary process. They have used grafts of the conjunctiva in 150 cases and feel

that this is the method of choice in the treatment of this condition. They employ B-radiation and cortisone to control revascularization.

David Shoch.

Zarrabi, M. **Some ocular complications in Iran associated with Asiatic influenza.** *Arch. d'opht.* 18:59-60, 1958.

Asiatic influenza has been widespread in Iran and there have often been ocular complications. These have consisted principally of follicular conjunctivitis with preauricular adenopathy, suggestive of epidemic keratoconjunctivitis but without the classical corneal signs. A number of cases of dendritic keratitis were seen during the influenza, as well as such other complications as hemorrhage into the vitreous, neuroretinitis, ocular muscle paralysis, and accommodative fatigue.

P. Thygeson.

Zarrabi, M. **Two cases of acute dacryoadenitis with dendritic keratitis.** *Arch. d'opht.* 18:57-58, 1958.

Two cases of dendritic keratitis in young adults are described in which identical signs and symptoms of acute dacryoadenitis were noted. Each case exhibited swelling of the upper lid, especially externally, and intense tearing. The lacrimal glands were enlarged and painful to touch. In each instance resolution required one and a half months. (2 figures)

P. Thygeson.

Zintz, R. **The preservation of corneas in paraffin oil.** *Klin. Monatsbl. f. Augenh.* 133:354-359, 1958.

Corneal tissue stored in paraffin oil at +3 C will remain transparent up to 20 days. The corneal cells degenerate earlier and after the eighth or tenth day normal cells can no longer be found in histologic sections. After the eighth day tissue cultures will not grow. Even the more resistant epithelium fails to grow. (4 figures, 1 table, 9 references)

Frederick C. Blodi.

8

UVEA, SYMPATHETIC DISEASE,
AQUEOUS

Minton, Joseph. **A clinical and pictorial survey of uveitis in childhood.** Tr. Ophth. Soc. U. Kingdom 77:255-265, 1957.

The author presents children who developed uveitis and polyarticular rheumatoid arthritis (Still's disease) and describes their response to treatment with the anti-inflammatory drugs and topical treatment. The use of ACTH was necessary over long periods of time. (7 figures) Beulah Cushman.

Perkins, E. S. and Beverley, J. K. A. **Toxoplasmic uveitis.** Tr. Ophth. Soc. U. Kingdom 77:159-172, 1957.

A diagnosis on the basis of a typical clinical picture of toxoplasmosis must be confirmed by specific laboratory tests with isolation of the organism or a favorable response to specific therapy. Three of the four criteria should be fulfilled to establish a new disease entity. The clinical picture of toxoplasmosis is the least well established except for the congenital type which is recognized by chorioretinitis. Patients with intracranial damage die young and in many adult patients the chorioretinitis is probably a result of congenital infections.

Manifestations of acquired toxoplasmosis in the adult are a generalized adenopathy resembling glandular fever. Chorioretinitis may occur as a late complication but any acute form is probably due to toxoplasmosis. Dye tests and complement fixation tests are specific tests. The dye test to a titer of 1:4 was found in 90 percent of the patients in the early age group of one of 19 years, the cases of posterior uveitis showing the larger number of positive findings. Pyrimethamine (daraprim) 25 mg. a day for a month (Burroughs, Wellcome) has been shown to possess an antitoxoplasmic effect in laboratory animals. (1 figure, 15 tables, 15 references) Beulah Cushman.

Yoshida, Eiichi. **Experimental studies on the pathogenesis of idiopathic uveitis. Inoculation test with human donors of patients of idiopathic uveitis.** Jap. J. Ophth. 2:177-182, Aug., 1958.

Intravitreal inoculation into rabbit eyes of subretinal fluid from patients with Harada type idiopathic uveitis produced uveitis and neuritis. This is most likely a heterologous protein reaction inasmuch as it was most difficult to produce subsequent uveitis by repeated passage of rabbit vitreous in the same species. (1 table, 8 references) Irwin E. Gaynon.

9

GLAUCOMA AND OCULAR TENSION

Betti, L. **Remarks on the etiology and pathogeny of primary glaucoma.** Boll. d'ocul. 37:225-235, 1958.

The author feels that on the basis of clinical, anatomic and pathologic studies it may be suggested that the cause of primary glaucoma is a loss of tonicity of the sphincter muscle and of the ciliary muscle. (6 references) Joseph E. Alfano.

De Rosa, Luigi. **Modification of the anterior chamber following cyclodialysis.** Rassegna ital. d'ottal. 27:199-203, May-June, 1958.

The author studied several cases of chronic noninflammatory glaucoma from the standpoint of the profundity of the modification of the anterior chamber following cyclodialysis. The examinations were made two months after the operation and showed that there was an almost constant decrease in the depth of the chamber. Marked decrease in the intraocular pressure was also seen in the nine cases studied. (1 table, 13 references)

Eugene M. Blake.

Duke-Elder, Sir Stewart. **The Bowman lecture. The etiology of simple glaucoma.** Tr. Ophth. Soc. U. Kingdom 77:205-228, 1957.

The author has reviewed the literature and provides a critical survey of the subject. He emphasizes the importance of not looking at the eye as though it were an isolated organ. A glaucomatous eye is a sick eye in a sick body. (3 figures, 1 table, 17 references) Beulah Cushman.

Ikuta, Keikichi. **Tonographic studies on human eyes. Report 4. Studies on the squint eyes.** Jap. J. Ophth. 2:221-225, Aug., 1958.

The tonicity of the extrinsic ocular muscles hinders the aqueous outflow and also increases the intraocular pressure. The rate at which fluid can be expressed is affected very little. There is a change in the steady state of aqueous flow and of the closed manometer pressure. The increase in scleral rigidity is less than would be expected on the basis of standard calculations. (1 table)

Irwin E. Gaynon.

Malbran, J. and Malbran, E. S. **Surgery of primary glaucoma.** Arch. Soc. oftal. hispano-am. 18:427-450, May, 1958.

The authors believe that the surgical indications and the choice of the surgical procedure depend chiefly on the state of the anterior chamber angle. For this reason they consider the published data of surgical procedures, without gonioscopic data, invalid for the assessment of surgical procedures. In addition to the visual acuity, visual field, and the condition of the crystalline lens, the most important examination is gonioscopy, which should reveal whether the angle is narrow or wide, and whether it is closed or open in the acute stage of hypertension. The authors present a classification of glaucoma based on the morphology of the anterior chamber angle, and point out the diagnostic difficulties of differentiation in a narrow angle, whether it is closed or open. Each gonioscopic appearance of the various types is described in detail. The

mechanism of action of the various anti-glaucomatous operations and the surgical indications are discussed in detail. The authors' surgical pattern is as follows. A peripheral iridectomy is done in cases of closed narrow angle glaucoma in which the tension and aqueous flow become normal when the angle opens, or under the use of miotics. In chronic cases, in which the tension remains high and the drainage impaired between acute attacks, diathermy of both lips of the wound is added to develop a filtrating cicatrix. In cases of open narrow angle glaucoma a filtrating iridectomy is the primary operation. In cases of wide open angle glaucoma a filtrating operation or cyclodialysis is indicated, although the value of the hypotensive result is questionable. The authors' material consists of 24 eyes, operated on by iridectomy with diathermy of the wound, 17 eyes of peripheral iridectomy without diathermy, and 14 eyes with cyclodialysis. These cases are analyzed and tabulated as to the preoperative tension, aqueous flow, the emptying of the anterior chamber during the surgical procedure, the postoperative tension, the type of cicatrix, and the postoperative use of miotics. The authors' data point to the gravity of the loss of the anterior chamber in cases of closed angle glaucoma during the surgical procedure or soon postoperatively. Of five cases with loss of the anterior chamber, three developed malignant glaucoma; of the two with favorable results, the narrow angle was open in one case and the other had a filtrating cicatrix. (4 tables, 22 references)

Ray K. Daily.

Reed, H. and Bendor-Samuel, J. E. L. **The detection of glaucoma before evidences of visual impairment.** Tr. Ophth. Soc. U. Kingdom 77:379-389, 1957.

The authors report on the results of performing routine tonometry as part of the eye examination of every patient over

the age of 40 years. They did not expect routine tonometry to uncover more patients with early glaucoma but were surprised that glaucoma was found in 2.9 percent of 2,000 patients examined. The diagnoses were confirmed by visual field examination with 20 mm. white targets, gonioscopy, repeated tonometry, the water drinking test, mydiatric tests or tonography. They note that 30 of the patients were found normal with the routine clinical examination and only tonometry revealed the presence of glaucoma. (7 tables, 12 references) Beulah Cushman.

Schofield, P. B. **Phacolytic glaucoma.** Tr. Ophth. Soc. U. Kingdom 77:193-203, 1957.

Phacolytic glaucoma is a term used for the mechanical blocking of the trabecular meshwork by macrophages engorged with lens material. The lens material may cause an anaphylactic reaction with inflammatory cell infiltration of the anterior uvea consisting of eosinophils, polymorphonuclear, endothelial cells, plasma cells, giant cells, lymphocytes and phagocytes. Usually the onset is acute in an eye with a long standing cataract. (4 figures, 12 references) Beulah Cushman.

Zita, Karl. **Ten years of experience with the Elliot trephine.** Klin. Monatsbl. f. Augenh. 133:342-353, 1958.

Zita reports 608 operations of which 459 were performed on eyes with chronic simple glaucoma. After five years the tension was found normal in nearly 50 percent of the eyes and in another 25 percent it could be made normal with miotics. The degree of success was about the same in patients with secondary glaucoma. The loss of vision could not be stopped in eyes with pseudoglaucoma. After five years, more than half of the eyes which had been operated upon showed an increase in lens opacities. (7 tables, 19 references)

Frederick C. Blodi.

10

CRYSTALLINE LENS

Doggart, J. H. **Congenital cataract.** Tr. Ophth. Soc. U. Kingdom 77:31-37, 1957.

The author states that 90 percent of people have congenital cataract but 90 percent of them will not affect visual activity. Many may be classified as a harmless developmental blemish and called a benign cataract. Cataracts interfering with sight may be the small anterior polar opacities, reduplication cataracts. Anterior polar cataracts may be accompanied by anterior lenticonus or posterior lenticonus. Zonular and rubellar cataracts often interfere with vision. The zonular type may show many grades of density. Rubellar cataract was first recognized as a clinical entity by Gregg in Australia in 1941. Hereditary cataracts may take the form of petals, a coralliform fretwork, or resemble a bunch of tyrosine crystals. Some of the inherited lenticular lesions may be morphologically identical with traumatic lesions or those resulting from infections or toxins. (5 references)

Beulah Cushman.

Friede, Reinhard. **Extraction of a lens luxated into the vitreous.** Klin. Monatsbl. f. Augenh. 133:407-409, 1958.

The luxated lens is speared with a two-pronged dissection needle. (1 figure)

Frederick C. Blodi.

Merriam, G. R. and Focht, E. F. **Radiation dose to the lens in treatment of tumors of the eye and adjacent structures; possibilities of cataract formation.** Radiology 71:357-369, Sept., 1958.

The amounts of radiation and the problem of shielding the eye in the treatment of tumors of the antrum, nasopharynx, ethmoids, cerebrum, pituitary gland, lacrimal gland, orbit, hard palate, nose, lids, and intraocular tumors are discussed.

Cataracts are most likely to occur in the treatment of carcinoma of the antrum with invasion of the floor of the orbit, carcinoma of the nasopharynx with involvement of the ethmoids, and in carcinoma of the hard palate.

The minimum dose that produced lens opacities was 200 r in a single treatment, 400 r if the treatment was spaced from three weeks to three months, and 550 r if the treatment was spaced over three months. (11 figures, 3 references)

Irwin E. Gaynon.

Nutt, A. B. **Surgical treatment of congenital cataract.** Tr. Ophth. Soc. U. Kingdom 77:39-57, 1957.

The surgical treatment of congenital cataract should be postponed except in infants with bilateral dense cataracts at birth, and these should be treated as soon as possible to allow development of the fixation reflex and to prevent amblyopia exanopsia, strabismus and nystagmus. Bilateral cataract present at birth indicates severe damage to the developing eye and it is unlikely that the other delicate ocular structures have escaped. The author doubts there is any material advantage to be gained from operation before the age of six months. The various surgical procedures are described.

Lamellar cataract should only be operated upon if the vision is sufficiently poor to interfere with normal development. In rubella cataract, a preliminary iridectomy is essential. In congenital Morgagnian cataract dissection with evacuation of turbid lens matter through a corneal incision is indicated. Glaucoma and detachment of the retina are the most common complications. Glaucoma may be the result of iris bombé or the blocking of the pupil by vitreous. (3 tables, 24 references)

Beulah Cushman.

Sobanski, Janusz. **Implantation of acrylic lens into anterior chamber in unilateral aphakia.** Klinika Oczna 28:1-4, 1958.

Two cases of implantation of an acrylic lens into the anterior chamber in monocular aphakia are presented. Strampelli's method and lens were used. In both cases there was mild iridocyclitis which cleared away without complications. In the second case there was an intraocular hemorrhage on the fourteenth day which pushed one of the ends of the lens under the iris. Despite this complication the eye recovered and with a small additional correction had 6/6 vision. In the first case vision was 6/12 without any lens. The first patient was observed for 12 months and the second for eight months without any symptoms of complications or irritation. (3 figures, 2 references)

Sylvan Brandon.

11

RETINA AND VITREOUS

Bernardczykowa, Anna. **A case of embolism of the central artery of the retina.** Klinika Oczna 28:39-43, 1958.

A case of closure of the lower branch of the retinal artery in a 54-year-old woman is presented. The author discusses the differentiation between embolus and spasm and finds it almost impossible to differentiate between them. In the presented case, hypertension, narrow peripheral blood vessels, symptoms of angina, and improvement in the visual field suggest spasm. Location of the block at the bifurcation, sudden onset during physical work, and slight change in the position of the block suggest an embolus. Only microscopic examination may clarify the etiology in each case. (3 figures, 8 references)

Sylvan Brandon.

Black, G. **The role of the sclera in operation upon the simple detachment of the retina.** Tr. Ophth. Soc. U. Kingdom 77:89-100, 1957.

The author emphasizes the disadvantages of scleral injury by transscleral dia-

thermy; necrosis and substitution by granulation and scar tissue and possible staphyloma formation may lead to stresses in choroid and retina with increased risk of further detachment.

The ideals to be sought after are to limit injury to all layers of the eye as much as possible, careful pre-operative marking of the site of the tear on the globe, accurate confirmation of the pre-operative marking by a pilot, diathermy application and careful ophthalmoscopy, and a maximal evacuation of fluid.

An analysis of failures was outlined: 1. deficient natural reaction to developing detachment, 2. excessive natural reaction to a developing detachment, and 3. long duration. (8 figures) Beulah Cushman.

Bossu, A. and Luypaert, R. **The syndrome of Usher.** *Ann. d'ocul.* 191:529-534, July, 1958.

The authors report the case of a young woman who had both retinitis pigmentosa and bilateral deafness (the Usher syndrome). Cataracts were also present but are not considered part of the syndrome. The authors feel that this represents a genetically determined degeneration (abiotrophy) of two similar tissues, the retina and the organ of Corti. These structures are embryologically similar. (12 references) David Shöch.

Burian, H. M. and Fletcher, M. C. **Visual functions in patients with retinal pigmentary degeneration following the use of NP 207.** *A.M.A. Arch. Ophth.* 60:612-629, Oct., 1958.

Severe damage to the rods and cones was found in the patients examined, as shown by perimetric, adaptometric, and electroretinographic studies. (10 figures, 25 references) G. S. Tyner.

Busacca, Archimède. **The biomicroscopic structure of the normal vitreous body.** *Ann. d'ocul.* 191:477-499, July, 1958.

The author gives a detailed description of the normal vitreous as seen with the slitlamp. He states that the vitreous is composed of a dense "luminous substance" immersed in an opaque, more fluid substance. Since the specific gravity of the former is greater it tends to accumulate inferiorly in the globe when the eye is stationary. The luminous substance is composed of lamellae and bands easily seen in the anterior vitreous. These thin membranes are divided into three groups: the central system which is the residuum of Cloquet's canal and usually lies below the optic axis is connected anteriorly to a system of folds which originate near the anterior limiting membrane of the hyaloid; the equatorial connections of this central system constitute the principal radial system and between these anterior and posterior layers is the zone of lacunae. Posterior to the principal radial system lies a mass of vitreous occupying $\frac{1}{3}$ to $\frac{1}{2}$ of the globe; the detailed characteristics of this portion are not clearly seen. (6 figures, 8 references) David Shöch.

Cashell, G. T. W. **Ocular changes after rupture of the liver.** *Tr. Ophth. Soc. U. Kingdom* 77:187-192, 1957.

The ocular changes are described in a boy, seven years of age, who sustained a rupture of the liver associated with the traumatic retinopathy of Purtscher, and compression cyanosis. (1 figure, 9 references) Beulah Cushman.

Elahyan, M. **Spasm of the central retinal artery in the course of surgery for strabismus.** *Arch. d'ophth.* 18:61-62, 1958.

The author notes that spasm of the central retinal artery can occur at any age but that arterial hypertension is the most important cause. Spasm may occur in other conditions, notably in hypotension and in various shock states such as intoxication, exposure to cold, fatigue, and emotional crisis. Up to now, however, no

report of spasm of the artery during strabismus surgery has been published. In a man, 35 years of age, undergoing surgery for strabismus, sudden loss of vision occurred simultaneously with severance from the globe of the right internal rectus muscle. Fundus examination showed ischemia of the retina and absence of light reflex. Retrobulbar injection of priscol effected recovery in 15 minutes.

P. Thygeson.

Ellison, J. **A case of retinoblastoma with postmortem findings.** Tr. Ophth. Soc. U. Kingdom 77:251-253, 1957.

The author describes a two-year-old boy who developed a mass in the right eye at nine months of age. The eye was removed with the optic nerve beyond cell extension. The child died in convulsions a week later. The widespread metastases extended to the parietal regions, the ribs and iliac bones; none were found in the other eye or in the vertebrae.

Beulah Cushman.

Geller, P. **A contribution to the ophthalmoscopic picture in vascular hypertension.** Klin. Monatsbl. f. Augenh. 133:570-572, 1958.

The hardened arteriole may not only compress but also push to one side the adjacent vein. This sign is not as rare as originally assumed. (1 figure)

Frederick C. Blodi.

Heinsius, Ernst. **A new method of scleral buckling in retinal detachment.** Klin. Monatsbl. f. Augenh. 133:360-368, 1958.

A strip of sclera 3 to 4 mm. wide is marked with the keratome. The sclera within the strip is treated with diathermy until it is completely singed. U-sutures are then put through the edges (Supramid, silk) and when they are tied the treated area is buckled in. The hole is treated separately and the subretinal fluid must be evacuated before the sutures can be

tied. The operation was successful in 14 of 27 patients who could be followed for more than two years. (10 illustrations, 3 references)

Frederick C. Blodi.

Lijo Pavia, J., Brage, D. and Novizki, I. **Macular coloboma associated with recessive hereditary malformations.** Rev. oto-neuro-oftal. 33:33-36, April-Aug., 1958.

The authors present the case history of a patient who had nystagmus, corneal opacities in one eye and keratoconus in the other, congenital cataractous changes, and bilateral macular coloboma. Other members of the same family, in which intermarriage was prevalent, demonstrated similar eye findings, difficulty in hearing, and oligophrenia. Oligophrenia was also one of the symptoms this patient had, and it was not possible to exactly classify the degree of mental retardation. The authors then review briefly the theories put forward to explain the formation of macular colobomas. (3 figures, 1 table)

Walter Mayer.

Miratynska-Rusinowa, Elzbieta. **Retinal circulation in diabetics.** Klinika Oczna 28:31-37, 1958.

The retinal blood pressure was examined in 226 diabetics. Arterial and venous pressure, systolic and diastolic, were recorded. Patients were divided according to age groups and the degree of retinal abnormality was also noted. In 38 patients the eyegrounds were normal. In others it was noted that the retinal blood pressure was lower than normal. Its level was correlated with the changes in the retina and suggested some damage to the vascular bed, in particular the presence of microaneurisms and hemorrhages. Normal retinal blood pressure in patients with diabetic retinitis and high pressure in patients with hypertension suggested that general hypertension and kidney damage may be associated with diabetes. The behavior of the retinal blood pres-

sure may help in differentiating between diabetic changes in the retinal vessels, secondary changes in the retina and changes due to general diseases of the blood vessels or circulation. (3 tables, 10 references)
Sylvan Brandon.

Moffat, P. McG. **Intravitreal vitreous in retinal detachment surgery.** Tr. Ophth. Soc. U. Kingdom 77:61-68, 1957.

The author reports on the use of intravitreal implants in the surgical treatment of detachment of the retina after the method of Donald Shafer of New York. The vitreous is aspirated from eye bank eyes with an 18 gauge needle six to 48 hours after enucleation. The sample is cultured after 48 hours. The recipient eye is treated by non-perforating intrascleral diathermy. The donor vitreous is introduced through a small radial incision, 4 mm. long and centered 9 mm. back from the limbus either in the upper or lower quadrant on the temporal side of the sclera. Two opposing mattress sutures are placed edge to edge. The needle is directed to the center of the globe and the sutures are tightened. When the point of the needle is seen to be inside the retinal cone the donor vitreous is slowly injected until the ocular pressure is raised to about 40 mm. and held there for two minutes when it is reduced to 30 mm. Hg. Reactions followed in some eyes but it was not determined whether these were the result of infection or an allergic reaction. Moffat's results in a small number of cases suggest that vitreous implant possesses some inherent advantages not obtained by the use of other fluids and gases hitherto employed. (5 references)

Beulah Cushman.

Osterczy, Hanna. **Retinoschisis.** Kilnika Oczna 28:45-47, 1958.

The author presents a case of retinoschisis in a 65-year-old woman. The outer layer of the retina on the temporal side

was contracted, presenting a fairly well-outlined greyish edge. The inner layer containing retinal tissue reached the periphery but was elevated and had a horse-shoe tear. Surgical treatment consisting of diathermo-coagulation and scleral shortening according to Weve was initially successful but eventually failed and loss of the eye resulted. (1 figure, 5 references)
Sylvan Brandon.

Riggs, Lorrin A. **The human electroretinogram.** A.M.A. Arch. Ophth. 60:739-754, Oct., 1958.

The nature of the electroretinogram is discussed and the progress in techniques that has been achieved is delineated. (17 figures, 58 references)
G. S. Tyner.

Scorciarini Coppola, A., Orlando, E. and D'Antuono, G. **Congenital vascular veils of the vitreous.** Boll. d'ocul. 37:210-224, March, 1958.

The authors present a case of congenital vascular veils in the vitreous in two brothers. General physical examination in both patients was negative except for some liver insufficiency and an increased vascular resistance. The proliferative and hemorrhagic aspects of the condition are discussed. (7 figures, 4 tables, 27 references)
Joseph E. Alfano.

Shapland, C. Dee. **Intravitreal vitreous in retinal detachment surgery.** Tr. Ophth. Soc. U. Kingdom 77:69-87, 1957.

The author describes the technique of obtaining the vitreous in detail and the preparation of the recipient eyes as well. One can aspirate 2 cc. of vitreous. In the cases in which the author used intravitreal vitreous the retinal detachments had recurred in an only eye and it seemed impossible to do further diathermy or sclerotomy. In four of the 12 patients the injection of vitreous played an important part in the replacement of the retina and in the other eight it resulted in the resto-

ration of some useful vision. (4 figures, 2 tables)
Beulah Cushman.

Schepens, C. L. and Okamura, I. D., Bulnes, L. S., Amenabar, M., McDónald, R., Pico, G. and Pierce, L. H. **Symposium: Retinal detachment.** Tr. Fifth Pan-Am. Cong. Ophth. 1:373-417, 1956.

Schepens, C. L. and Okamura, I. D. **The peripheral retina.** pp. 373-377.

Two aspects of the anatomy of the peripheral retina are discussed: 1. some anatomical features of the peripheral retina itself and 2. the relations between the peripheral retina on one hand and the choroid and vitreous body on the other.

Clinical observations are restricted to those pertaining to retinal detachment. Examples are chosen from observations made on more than 4,000 patients who were examined at the Clinical Unit of the Retina Foundation. Examples of changes which are determined by normal anatomical features of the extreme fundus periphery are 1. retinal detachment extending under the ciliary epithelium through the ora serrata and 2. cysts of the pars plana ciliaris. Changes caused mainly by alterations in the normal anatomy of the peripheral retina are retinal tears resulting from exaggerated meridional folds and retinal tears caused by abnormally located vitreoretinal adhesions.

Six types of retinal detachment, caused by changes in the extreme fundus periphery are briefly described. They are 1. classical retinal dialysis in the young; 2. traumatic retinal dialysis; 3. typical retinal detachment observed after an uncomplicated cataract extraction; 4. retinal detachments observed after a cataract extraction complicated by a large vitreous loss; 5. retinal detachment occurring after a cyclodiathermy operation performed for relief of glaucoma; and 6. subclinical retinal detachments. (11 references)

Bulnes, Luis Sanchez. **Etiology and pathogenesis.** pp. 381-387.

The author calls attention to the lack of uniformity in the classification of retinal detachment, artificially divided in two groups: idiopathic and secondary, notwithstanding the fact that many idiopathic forms are in reality secondary. The factors which are considered as predisposing such as hereditary, race, occupation, age and refraction, are pointed out and the author analyzes the various etiopathogenic theories.

Amenabar, Mario. **Localization and examination methods.** pp. 389-397.

The ophthalmologist must be able to make a perfect localization of the retinal hole by means of indirect and direct ophthalmoscopy and he must know how to close the hole with the minimum of trauma with the diathermy.

A small, fresh, flat detachment of the retina can be seen much more easily with the indirect system and can be overlooked with direct ophthalmoscopy. Once the retinal tear has been found by the indirect method, direct ophthalmoscopy must be used to study its shape, borders, size and topography. To localize the retinal tear two instruments are used: the retinal hole localizer and the scleral marker. The localizer is a transilluminator devised so that the surgeon may slide it easily on the sclera, reaching without effort any part of the globe to be operated on except the macula. The scleral marker makes three conspicuous marks on the scleral projection of the tear. The ophthalmologist is then in a position to close it with a minimum of trauma, making a very concentrated diathermy electrocoagulation. He is able to cure a high percentage of patients with detachment of the retina.

McDonald, Robb. **The surgical treatment.** pp. 399-405.

Proper examination and location of the tear or tears will confine diathermy to the disturbed areas and bring about better postoperative results. Extensive "blind" coagulation of the scleral bands may pro-

duce severe vitreous changes and the author does not recommend it. Lamellar scleral resections with or without polyethylene tubing have their best indication in those cases in which the retina settles poorly, when one or more star-shaped folds are present, in aphakia and myopic detachments, and in patients with multiple areas of peripheral degeneration. One of the advantages of this type of surgery is the early ambulation, as early as 48 hours (Clark) or from four to six days (Schepens). (16 references)

Pico, Guillermo. **Postoperative care.** pp. 407-414.

Comfortable bed rest is the secret of avoiding restlessness of the patient. Arruga's statement that for the first three to four hours the diathermy punctures are still draining has led to the practice in some instances of discharging the patients immediately after operation with binocular dressings so they can spend their convalescence at home. Although this is not ideal it sometimes is the only possible course. Routine postoperative care should be carefully followed in the elderly patients. Ophthalmoscopy should be delayed for at least one week.

Steroids can be used to minimize postoperative reaction but not to the point of preventing the formation of a chorioretinal scar. Removal of sutures should be delayed until after the second week if possible, pinhole goggles should be used from five to six weeks after discharge from the hospital. The handling of patients with incomplete reapposition of the retina, recurrent retinal detachment, and late total retinal detachment is discussed. (11 references)

Pierce, L. Harrell. **Subclinical retinal detachment.** pp. 415-417.

This term is used to describe retinal detachment which has not caused any symptoms, nor has affected visual acuity or the peripheral fields. This is often peripheral with minimal elevation and the

diagnosis is difficult. A widely dilated pupil, a dark room and an indirect ophthalmoscope are needed. Scleral indentation is indispensable for the examination of the extreme periphery. A report on 24 patients in whom 31 eyes showed subclinical retinal detachment showed that 11 of the patients had detachments in the other, the apparently healthy, eye.

Of these eyes, 26 were operated upon, ten with surface diathermy alone, eight with diathermy plus scleral drainage and eight with penetrating diathermy. The choice of treatment was determined largely by the amount of subretinal fluid thought to be present. Successful results were obtained in 96 percent of the cases. In view of the fact that many of the subclinical detachments progress to clinical detachments, and of the good results of treatment, the author now is more inclined to advise surgery than he formerly was.

Gustavo Scioville-Samper.

Trautmann, Ilse. **The testoviron treatment of diabetic retinopathy.** *Klin. Monatsbl. f. Augenh.* 133:377-383, 1958.

Improvement occurred in only four out of 20 patients. (3 tables, 71 references)

Frederick C. Blodi.

13

NEURO-OPHTHALMOLOGY

King, E. F., Russell, W. R. and Rowbotham, G. F. **The facial neuralgias.** *Tr. Ophth. Soc. U. Kingdom* 77:319-346, 1957.

King, E. F. pp. 319-330.

Facial neuralgia, a pathological process affecting the trigeminal nerve or some lesion which interferes with its function, is associated with variable pain restricted to one or more of its branches and associated with sensory changes in the overlying skin. Pain may precede a vesiculation. Iridocyclitis of a mild serous type which may show a tendency to spontaneous hyphema may complicate the infection. Ex-

traocular palsies affecting the third, fourth or sixth and seventh cranial nerves are not unusual and recover within two weeks. The internal ophthalmoplegias rarely recover completely. Episcleritis is occasionally reported and optic neuritis is a rare complication.

Charlin's syndrome associated with pain on the side of the nose and around the medial canthus is often a latent symptom associated with intermittent rhinorrhea. Sluder's syndrome, probably due to inflammation of the sphenopalatine ganglion, produces lower-half headache; block of the sphenopalatine ganglion gives relief.

Tic douloureux is a facial neuralgia usually affecting the second and third branches of the trigeminal nerve in women of middle age. Pain, often initiated by mechanical stimuli, is intense, described as "illimitable in agony," and occurs in bouts lasting weeks or months interspersed with periods of complete relief. The only ocular disturbances are lacrimation and conjunctival congestion. Ciliary neuralgia must be differentiated from the classical syndrome of migraine. (1 figure, 2 tables)

Russell, W. Ritchie. pp. 331-336.

The nature of the pain must be analyzed and reproduced if possible to aid in the diagnosis, by vasodilators or the injection of histamine. An injection into the neck may produce frontal pain. Patients with ophthalmic herpes have been treated with prednisolone and achromycin which seemed to lessen the scarring but loss of sensation develops as usual. Postherpetic neuralgia can be prevented by thorough treatment of the acute stage. One must avoid the common mistake of protecting the scarred area. Local nerve blocks give temporary relief of pain. Percussion therapy removes the hyperesthesia by applying the massage lightly for five to ten minutes. (5 references)

Rowbotham, G. F. pp. 337-346.

Major trigeminal neuralgia is one of the

most painful conditions met with in medicine and innumerable cures have been suggested. As quiescent periods shorten and the pain becomes more widespread the patient finally develops a deficiency disease because of the inability to masticate and swallow food. Relief from pain can be achieved by injection or nerve section. Injections can be made into the Gasserian ganglion at the second division of the trigeminal extracranially at the foramen ovale, into the infraorbital nerve at the infraorbital foramen, and into the supraorbital group at the supraorbital notch. Injection may be carried out with the aid of general anesthesia.

Relief is obtained only by numbing part or the whole of the face and the patient should be warned of this in advance.

Beulah Cushman.

Parry, R. **An unusual case of Marcus Gunn syndrome.** *Tr. Ophth. Soc. U. Kingdom* 77:181-185, 1957.

A patient is described who had a congenital condition in which there was a partial ptosis, and when the jaw was opened the upper lid on the affected side was raised to a higher level than on the normal side, but was not maintained if the jaw was kept open. The synkinetic movement involved the third cranial nerve and external pterygoid branch of the fifth. The sterno-mastoid muscle and tongue were affected, single binocular vision was present most of the time, and there was an associated fatigue factor. (7 figures)

Beulah Cushman.

Tucker, S. M. **Herpes zoster ophthalmicus in children.** *Arch. Dis. Child.* 33: 437-439, Oct., 1958.

Tucker reports a case of herpes zoster ophthalmicus in a child aged six years. It differed from the usual pattern in several respects. The child was extremely ill and toxic when the herpes became evident, hair was lost in the ophthalmic division

and normal vision had not been regained one year later. The author points out that Edgerton found about 2,250 cases in the world literature and only 40 of them occurred in children under 13 years of age. The relation of the virus to that of varicella is discussed. (1 figure, 23 references)

F. H. Haessler.

15

EYELIDS, LACRIMAL APPARATUS

Bauer, Horst. **Ocular involvement in oligosymptomatic Hand-Schueller-Christian disease.** *Klin. Monatsbl. f. Augenh.* 133:478-481, 1958.

A six-year-old boy had numerous xanthomas of the skin. There were a number of xanthomas in all four lids causing a marked thickening of these organs. There was also a limbal xanthoma on the right eye which encroached upon the cornea. Histologic examination of a skin nodule showed a typical xanthoma. The skeletal system was not involved. The lid xanthomas were excised and a skin plastic successfully covered the defects. (2 figures, 14 references)

Frederick C. Blodi.

Calmettes, Deodati and Bec. **Hereditary distichiasis.** *Bull. Soc. belge d'ophth.* 118:333-336, 1958.

Congenital hereditary distichiasis is a rare malformation. It is characterized by the formation of an additional row of lashes which are apparently derived from the Meibomian glands; they are finer, shorter and less colored than the original lashes. During infancy they are fairly well tolerated because of their delicate structure. Later in life they cause photophobia, lacrimation, and corneal trauma. The treatment of choice is repeated electrolytic epilation. The anatomic and pathologic details of this anomaly have been investigated by various authors. A surprising analogy was found between the

evolution of the Meibomian glands and the growth of lashes during embryonic life. During this period disturbances of various kinds may modify the normal pattern of development. The comparative anatomy suggests the possibility of a phylogenetic origin. Many mammals do not have Meibomian glands. Sebaceous glands show identical structures. The conjunctiva of the lower mammals still has the character of epidermis and so carries hair and glands peculiar to the skin.

In two subjects who are reported, a 10-year-old child with all four lids involved, and a 34-year-old man who had the anomaly on both lower lids only, the family history demonstrated the dominant hereditary trait of this anomaly. (1 figure, 8 references)

Alice R. Deutsch.

Copeman, P. W. M. **Treatment of recurrent styes.** *Lancet* 2:728-729, Oct. 4, 1958.

Over 90 percent of patients with recurrent styes were found to carry staphylococcus aureus in the anterior nares. This is a far higher figure than that found among the general population and among those having styes sporadically. Although treatment of the nares alone is generally sufficient, the application of nonsystemic antibiotics to both the eyelids and the anterior nares may be necessary. (21 references).

Irwin E. Gaynon.

Elliot, A. J. **Lacrimal hyposecretion.** *Canad. M.A.J.* 79:371-378, Sept. 1, 1958.

The multiple conditions associated with a deficiency of lacrimal secretion are classified and discussed. Congenital absence of tears is relatively rare and is usually associated with other systemic symptoms. In elderly patients it is fairly common to find lacrimal hyposecretion due to a senile atrophy of the gland, but this seldom produces significant symptoms. Keratoconjunctivitis sicca, or Sjög-

gren's syndrome, is relatively rare and occurs predominantly in postmenopausal women. Symptoms of corneal dryness and erosions are frequent and severe and are often accompanied by filamentary keratitis. A deficiency of salivary secretions and polyarthritis are commonly present in this condition. Corneal hypesthesia may be present. Treatment consists of supplying some type of artificial tears by a solution such as methylcellulose. In cases in which this alone is not sufficient, the lacrimal puncta should be sealed. The author reports nine cases in which this was done with subjective and objective improvement. The value of the Schirmer test is stressed. Hormonal therapy is not felt to be of much value.

Lacrimal hyposecretion may also result from obstruction of the lacrimal ducts following burns, pemphigus, or trachoma. A paralytic hyposecretion may occur when any of the nerves to the lacrimal gland are paralyzed. This may be seen in herpes of the geniculate ganglion and in basal skull fractures in which the greater superficial petrosal nerve is torn. Operations for tic douloureux and acoustic neuroma may also cause this. Intoxication with certain of the belladonna drugs will also lead to lacrimal deficiency because of their direct action on the lacrimal gland. (1 figure, 3 tables, 28 references)

William S. Hagler.

Josten, K. **Scleroderma en coup de sabre and the eye.** *Klin. Monatsbl. f. Augenh.* 133:567-570, 1958.

In this localized form of scleroderma a small, vertical zone on the lid is involved. Two cases are described in which the upper lid was also affected. The second patient, a 36-year-old man had retinal hemorrhages and the picture of a central vein thrombosis on the same side. (2 figures, 21 references)

Frederick C. Blodi.

Law, Frank W. **A case of lacrimal obstruction.** *Tr. Ophth. Soc. U. Kingdom* 77: 173-180, 1957.

The author describes an interesting case of tear sac infection with X-ray delineation with Meohydriol or Vikiosol and the disappearance of all symptoms after an emergency appendectomy. (8 figures)
Beulah Cushman.

Sommer, Gerd. **Ectopic lacrimal gland.** *Klin. Monatsbl. f. Augenh.* 133:415-417, 1958.

In a 14-year-old boy a conjunctival fold covered a large segment of the cornea from above and the temporal side. This piece of conjunctiva contained lacrimal gland tissue. The eye also showed ptosis and esotropia. (1 figure, 5 references)

Frederick C. Blodi.

Stallard, H. B. **Resection and advancement of levator palpebrae superioris through an anterior approach; some points in technique.** *Tr. Ophth. Soc. U. Kingdom* 77:101-107, 1957.

The author pleads for an anatomic anterior approach with the use of a lid guard for the dissection of the levator palpebrae superioris through a skin incision. With this approach the structures lie in their normal anatomic relations and any unusual attachments or a greater length may be adjusted by dissection; accurate suturing to the anterior surface of the tarsal plate and the achievement of the proper curve of the tarsal plate of the upper lid margin can be effected. The surgical procedure is described step by step. The operation belongs properly to the eye surgeon rather than the plastic surgeon. (5 figures) Beulah Cushman.

Tiberi, G. F. **Solid carcinoma of the lacrimal sac, a clinical histological contribution.** *Arch. di ottal.* 62:27-43, Jan.-Feb., 1958.

This is a review of the literature and a report of one case. The patient developed a carcinoma at the age of 73 years after two years of acute purulent dacryocystitis. (36 references) Paul W. Miles.

Vit, H. **The surgical treatment of extensive carcinomas of the lower lid.** Klin. Monatsbl. f. Augenh. 133:544-551, 1958.

Two cases are described and in both the original method of W. Hughes was modified because of too large a skin defect. Tarsus and conjunctiva were replaced from the upper lid. Skin covering was obtained by a sliding flap, once from the temple, and in the second case from the cheek. (12 figures, 4 references)

Frederick C. Blodi.

Ziemssen, Ch. **Granuloma anulare of the lid.** Klin. Monatsbl. f. Augenh. 133:562-566, 1958.

A seven-year-old boy developed a number of soft, pale red nodules on both lids of the right eye. Biopsy revealed a granuloma anulare. The boy was free from tuberculosis. (4 figures, 37 references)

Frederick C. Blodi.

16

TUMORS

Dollfus, M. A., Guérin, R. A. and Guérin, M. T. **Utilization of radio-isotopes in the diagnosis of ocular tumors.** Arch. d'opht. 18:5-16, 1958.

The authors review the literature on the use of radio-isotopes in the diagnosis of ocular tumors and report their own observations on 50 patients since 1954. Their results in 14 cases of melanoma, in which the diagnosis was eventually established microscopically, were positive in 12 and doubtful in two. One of the two doubtful cases had a very small posterior tumor. The other case was monocular and comparison had to be made with the

empty orbit. In four metastatic tumors the test was sharply positive in three. The single case of retinoblastoma in an infant was negative—an expected finding since these tumors have little affinity for P^{32} . In two cases of unilateral exophthalmos due to pseudotumor, the P^{32} test was negative, but it was positive in a case of cylindroma of the lacrimal gland with exophthalmos. In a case of epithelioma of the bulbar conjunctiva at the limbus, the test was positive, whereas in a diffuse conjunctival melanosis it was negative. Negative tests were obtained in a variety of diverse conditions, including cataract, absolute glaucoma, and uveitis. The authors conclude that the test is not absolute and must be interpreted with caution. (5 figures, 24 references)

P. Thygeson.

Dorello, Ugo. **Coincidence of melanoma in one eye and an idiopathic detachment of the retina in the other.** Rassegna ital. d'ottal. 27:192-198, May-June, 1958.

The patient was a 20-year-old man who observed failure of vision in the left eye which was caused by a detachment of the retina. Examination of the right eye disclosed a condition diagnosed as a tumor. Owing to the seriousness of the condition a biopsy was performed on the right eye which showed a melanoblastoma. Enucleation of the eye followed and sections made from the globe confirmed the diagnosis. Diathermy coagulation of the left eye led to reattachment of the retina. The case appears to be unique, especially in a 20-year-old person. (4 figures) Eugene M. Blake.

Pagani, Luciano. **Benign oculodermic melanosis.** Rassegna ital. d'ottal. 27:222-235, May-June, 1958.

Melanosis of the skin of the lids and sclera is of two types, one congenital, the

other malignant and perhaps precancerous. There has been considerable confusion in naming the disease entity. Some pathologists feel that the congenital type increases during maturity. It is probable that there is an hereditary predisposition in some cases of monozygotic character. Oriental observers hold that the picture is an atavistic change and more common in dark-skinned people. The pigmentary changes are found in three structures: the sclera, the iris and the fundus. Two cases are related in detail, one in a man who was 24 years of age and the other who was 47. Minute study of the pigmentation is reported. (3 figures, 61 references)

Eugene M. Blake.

17

INJURIES

Barclay, T. L. **Diplopia in association with fractures involving the zygomatic bone.** *Brit. J. Plastic Surg.* 11:147-157, July, 1958.

Of 383 patients with fracture of the malar and zygomatic bones seen in a ten year period, 32 (8.4 percent) were observed to have diplopia and 19 of these (4.9 percent) had transient diplopia that disappeared in less than two weeks, even without treatment of the zygomatic fracture. In 13 cases (3.4 percent) the diplopia persisted for two months or longer.

All of the cases of transient diplopia were associated with a simple fracture, and since the diplopia always clears spontaneously, it is suggested that the diplopia is due to "reflex inhibition or damage to the inferior oblique muscle of the eye on the injured side." Most of the cases of persistent diplopia were associated with comminuted fractures involving the lateral portion of the orbital floor. In these cases the author feels that the diplopia results from "fibrosis and adhesion formation in the region of the inferior rectus and inferior oblique mus-

cles" which prevent upward rotation of the globe. This is best treated by wide periosteal dissection of the orbital floor with the insertion of a bone graft. This not only frees the old adhesions but also prevents new ones from forming. In the five patients treated by this method by the author all had complete disappearance of the diplopia within eight days. (8 figures, 6 tables, 6 references)

William S. Hagler.

Battistini, A. **Alterations of the visual apparatus in an epidemic of toxic motor polyneuritis.** *Arch. di ottal.* 62:53-65, Jan.-Feb., 1958.

In the manufacturing of shoes, workers used a rubber base cement containing triorthocresylphosphate. Eleven became ill and complained for about 25 days of headache, vertigo, nausea and vomiting, sweating of hands and feet, cyanosis, skin desquamation and anemia. Vision was reduced to about 2/50 or worse, because of central and paracentral scotomas. Pupillography was negative. The EEG showed toxic changes and the electromyogram was diminished.

Evidences of retrobulbar neuritis were alterations in the color sense, bilateral temporal pallor, and irreversible central scotoma. (7 figures, 1 table, 18 references)

Paul W. Miles.

Jaensch, P. A. **Experiences with early operations (Passow) in chemical burns of the eye.** *Klin. Monatsbl. f. Augenh.* 133:482-487, 1958.

Chemical burns to 29 eyes of 24 patients were observed during the last three years. They were all treated according to the method of Passow with numerous incisions into the damaged conjunctiva. This allows the toxic edema to escape and increases vascularization. Thirteen eyes were injured by lime, six by an alkali, six by acids and four by a molten metal. Only once was an enucleation necessary and

five eyes became practically blind. The results were better than with other treatments. (12 references)

Frederick C. Blodi.

18

SYSTEMIC DISEASE AND PARASITES

Bruntse, E. **Ocular sarcoidosis; report of five cases with fundus changes.** Danish Med. Bull. 5:217-227, Oct., 1958.

Ocular lesions may occur at any time during the course of sarcoidosis. It is often the initial lesion and may be limited to the eye. Infiltrates or nodules have been described in the conjunctiva, sclera, uvea, retina, optic nerve, and perhaps, the cornea. Iridocyclitis is most common and a conjunctival lesion is next in frequency, whereas the lesions of the sclera, cornea and fundus are relatively uncommon. (52 references)

Irwin E. Gaynon.

Evans, P. J. **Ocular signs of metabolic diseases in children.** Hawaii Med. J. 17: 448-451, May-June, 1958.

The ocular signs of certain metabolic diseases occurring in children are briefly

discussed. In cystenosis there are typical deposits of cysteine crystals in the cornea and conjunctiva which can be recognized by slitlamp examination. Galactosemia is characterized by the formation of lamellar cataracts which are reversible in early stages. Tay-Sachs disease and Niemann-Pick diseases are associated with lipoid degeneration of the retina as well as of the central nervous system. Patients with Hand-Schüller-Christian disease have characteristic lipoid deposits in the flat bones of the skull. These deposits may fill the orbit and cause proptosis. In Gaucher's disease yellowish-brown pingueculae have been described. The Kayser-Fleischer ring on the posterior corneal surface is said to be pathogenic of Wilson's disease, and it has been reported that BAL will increase the excretion of copper and reduce this corneal pigmentation. In Hurler's disease the corneas show diffuse cloudiness of the interstitial layers. Both megalocornea and buphthalmos have been reported as occurring in this disease. (5 figures, 5 references)

William S. Hagler.

NEWS ITEMS

EDITED BY DONALD J. LYLE, M.D.
411 Oak Street, Cincinnati 19, Ohio

News items should reach the editor by the 10th of the month. For adequate publicity, notice of postgraduate courses and meetings should be received three months in advance.

DEATHS

Dr. A. Magitot, September 6, 1958, aged 80 years.

Mr. J. D. Wardale, emeritus professor of ophthalmology, University of Durham, and honorary consulting surgeon to the Royal Victoria Infirmary, Newcastle upon Tyne, December 7, 1958, aged 90 years.

Dr. Edward John Donnelly, Philadelphia, Pennsylvania, died October 11, 1958, aged 52 years.

Dr. Horace Greeley, Tuskegee, Alabama, died September 30, 1958, aged 49 years.

Dr. William Bruna Ebeling, Brooklyn, New York, died September 13, 1958, aged 67 years.

ANNOUNCEMENTS

OHIO STATE COURSE

Speakers on the program for the Postgraduate Course in Ophthalmology at the Ohio State University, March 2nd and 3rd, will be: Dr. Paul A. Chandler, Boston; Dr. William H. Havener, Columbus; Dr. Wendell L. Hughes, Hempstead, New York; Dr. Ralph O. Rychener, Memphis; and Dr. Samuel Saslaw, Columbus.

EYES IN INDUSTRY COURSE

From March 9th through 12th at the college of Medicine, University of Cincinnati, Cincinnati, Ohio, will be held an intensive course in industrial ophthalmology. On the faculty will be: Dr. Taylor Asbury, Dr. Charles K. W. Ascher, Mr. Faber Birren, Dr. Albert A. Brust, Dr. Alan S. Freemond, Dr. John C. Fuhs, Dr. Joseph Ginsberg, Dr. Emily Rogers Hess, Dr. Robert A. Kehoe, Dr. N. D. Kephart, Dr. Hedwig S. Kuhn, Dr. Donald J. Lyle, Dr. T. F. Schlaegel, Jr., Dr. Edmund B. Spaeth, and Dr. Gustave Strehel.

The program includes: "Introduction and welcome," Dr. Kehoe and Dr. Lyle; "Anatomy and physiology of the eye," Dr. Fuhs; "Basic principles of optics and refraction," Dr. Asbury; "Abnormalities of the eye," Dr. Freemond; "Reaction of the eye to injury: Pathologic anatomy," Dr. Ginsberg; "Retinal photography," Dr. Brust.

"Matching physical capability to job demands," Dr. Kephart; "Color and illumination in industry," Mr. Birren; "Screening for glaucoma," Dr. Asbury and Dr. Ascher.

"Eye injuries and their treatment," Dr. Kuhn; "Eye hazards and eye protection program," Mr. Strehel; "Patient demonstration," Dr. Hess; "Informal discussion of industrial eye problems," Dr. Lyle.

"Planning and equipping an eye room," "Vision programs in industry and what industry is doing

and results of industry programs," Dr. Kuhn; "The definition of legal blindness," Dr. Spaeth; "Compensation, public liability, product liability, secondary injury," "Psychosomatic eye problems," Dr. T. Schlaegel.

MOUNT SINAI COURSES

The Mount Sinai Hospital of New York City together with Columbia University is giving the following courses: "The use of the Schepens' ophthalmoscope" from March 10th to 26th; "Histopathology of the eye" from April 1st to April 24th. Complete information can be obtained from the Registrar for Medical Instruction, The Mount Sinai Hospital, 1 East 100th Street, New York City.

SURGERY IN SOUTH AMERICAN CLINICS

The Pan-American Association of Ophthalmology has approved of the idea of having qualified American and Canadian eye surgeons spend some time doing some special type of eye surgery in certain South American clinics.

The American and Canadian ophthalmologists should apply to Dr. Derrick Vail, 700 North Michigan Avenue, Chicago 11, Illinois, and, having been approved by Dr. Vail, they can write directly to the South American clinics, the list of which will be sent to them after Dr. Vail's approval.

TONOMETER TESTING STATION

A tonometer testing station has recently been established at the Glaucoma Research Unit of the Victorian Eye and Ear Hospital, Melbourne. Both the weighted and the weightless types of tonometer can be checked and a small nominal charge (£1. Aust.) is made for this service.

It is anticipated that this service will be of interest to oculists in Australia, New Zealand, and South East Asia.

Inquiries, and tonometers, should be addressed to: Dr. Geoffrey Serpell, Medical Officer to Tonometer Testing Station, The Victorian Eye and Ear Hospital, Victoria Parade, Melbourne, Australia.

FILMS FOR PAN-AMERICAN MEETING

Any person having films on ophthalmologic subjects who would desire to show them at the Pan-American Congress of Ophthalmology in Venezuela in 1960 (January 31st to February 7th) should contact either Dr. Wendell L. Hughes, 131 Fulton Avenue, Hempstead, New York, or Dr. Louis J. Girard, Hermann Professional Building, Houston 25, Texas, as soon as possible.

These films should be new films that have not been shown elsewhere. A summary of the film with the title should be sent, along with data as to whether it is silent or sound (optical or magnetic), the length of showing time, and a summary of the subject matter.

SOCIETIES

GREATER MIAMI SOCIETY

The Greater Miami Eye, Ear, Nose, and Throat Society meets quarterly in March, May, October, and December on Thursday evenings at the McAllister Hotel, Miami, Florida. It has elected the following officers for 1959: president, Dr. Mariano C. Caballero; vice-president, Dr. Joseph Freeman; secretary-treasurer, Dr. H. Carlton Howard.

SOUTHEASTERN SECTION

The initial organizational meeting of the newly delineated Southeastern Section of the Association for Research in Ophthalmology, Inc., was held on December 5 and 6, 1958, in Winston-Salem, North Carolina. A list of the present trustees who have agreed to participate in the activities of the section includes:

W. Banks Anderson, Duke University School of Medicine; F. Phinizy Calhoun, Jr., Emory University School of Medicine; Ronald A. Cox, George Washington University School of Medicine; John Fair, Medical College of Georgia; DuPont Guerrier, III, Medical College of Virginia; Pierre G. Jenkins, Medical College of South Carolina; Phillip Meriweather Lewis, University of Tennessee College of Medicine; Samuel D. McPherson, University of North Carolina; Edward W. D. Norton, University of Miami School of Medicine; Henry Carrol Smith, Vanderbilt University School of Medicine; Frederick W. Stocker, Duke University School of Medicine and McPherson Hospital; Richard G. Weaver, Bowman Gray School of Medicine; R. Winston Roberts, Bowman Gray School of Medicine, perma-

nent section secretary and ex officio member of the Board of Trustees.

Nomination of Dr. J. Harry King, Georgetown University School of Medicine, as a new member of the Board of Trustees was made and seconded, and his election was unanimous. It was then also agreed that as soon as a department head had been appointed at the newly formed University of Florida School of Medicine, he would be invited to serve as a trustee for this Section.

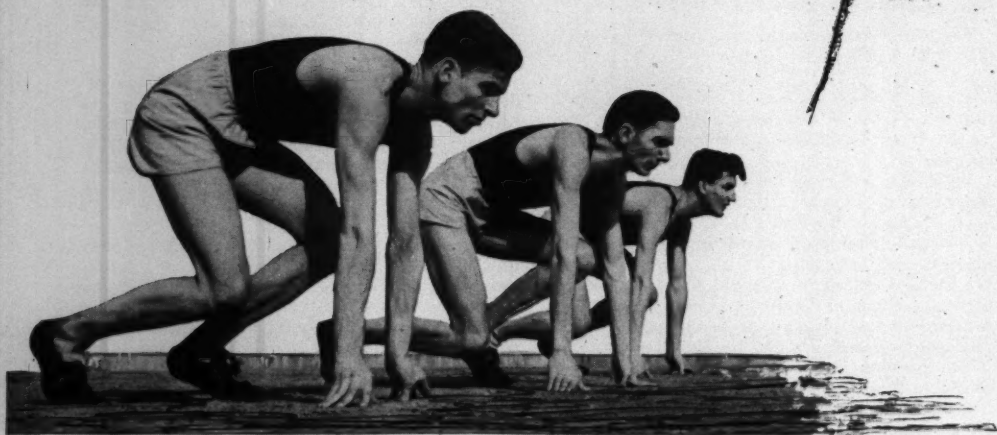
The group will meet next at Augusta, Georgia, at the Medical College of Georgia, with Dr. Fair chairman for the meeting.

PERSONALS

Dr. V. Everett Kinsey, Detroit, has been selected by *Modern Medicine*, to receive a 1959 award for distinguished achievement for his fundamental work on retrolental fibroplasia and the basic physiology underlying the development of glaucoma.

Dr. Phillips Thygeson, San Jose, California, delivered the 13th Francis I. Proctor Lecture on Ophthalmology, on December 5, 1958, at Morrison Auditorium, Golden Gate Park, San Francisco. The subject of Dr. Thygeson's address was "Morphologic observations on corneal lesions due to viruses."

Prof. Frank B. Walsh of the Wilmer Institute, The Johns Hopkins University, made a lecture tour of South America at the invitation of and sponsored by the Pan-American Association of Ophthalmology. Professor Walsh visited São Paulo and Rio de Janeiro in Brazil, Montevideo (Uruguay), Buenos Aires (Argentina), Santiago (Chile), Lima (Perú), and Bogotá (Colombia) where he was received by the different ophthalmologic societies. In São Paulo Professor Walsh also gave a class at the Escola Paulista de Medicina. His lectures were greatly enjoyed by his Latin American colleagues.



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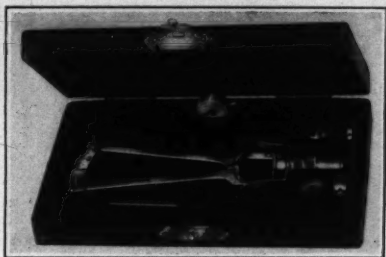
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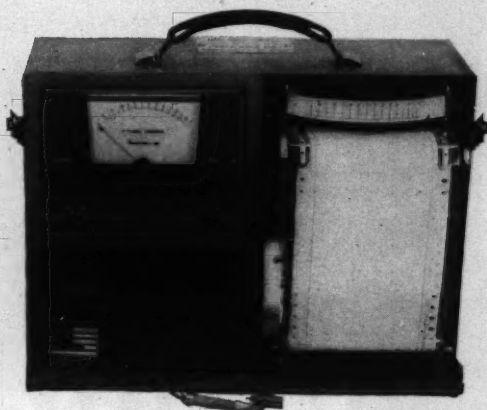
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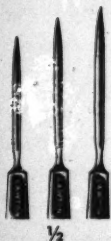
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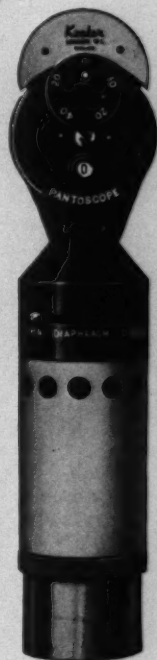
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